DOCUMENT RESUME

ED 471 141 SE 067 005

AUTHOR	Emerson, Eva
TITLE	Habitats NatureScope[R] Kit.
INSTITUTION	National Wildlife Federation, Reston, VA.
PUB DATE	2002-00-00
NOTE	212p.; Schoolyard Habitats[R] Program is supported by the Wege Foundation.
AVAILABLE FROM	National Wildlife Federation, 11100 Wildlife Center Drive, Reston, VA 20190 ($39.95). Tel: 703-790-4100; Web site: http://www.nwf.org.
PUB TYPE	Guides - Classroom - Teacher (052)
EDRS PRICE	EDRS Price MF01 Plus Postage. PC Not Available from EDRS
DESCRIPTORS	Biology; Elementary Education; *Hands on Science; Instructional Design; *Interdisciplinary Approach; *Science Activities; Science Curriculum; Science Instruction

ABSTRACT

This kit introduces the basic concepts of habitat through challenging and engaging interdisciplinary, hands-on activities. The material is designed for K-8 educators working in traditional and non- traditional classrooms with the goals of increasing awareness of the ways habitats work and why they are important. This kit consists of four components: (1) Kit Tips Module--general tips on creating an inclusive setting to make activities accessible to all students and to facilitate learning in outdoor settings such as camps, weekend programs, museums, and zoos; (2) Background Module--provides content and background information to prepare educators to guide their audiences through explorations of the natural world; (3) Activity Module--contains 15 activities designed to spark learner interest and motivate learning through hands-on explorations and discusses subject areas explored, skills developed, approximate time the activity will take, materials needed, learning objectives, tips on preparing, procedures for doing the activity, and extension opportunities; and (4) Schoolyard Habitats Guide Module--outlines how the audience can take action to help wildlife by designing, creating, and maintaining a National Wildlife Federation (NWF) certified Schoolyard Habitats site. (KHR)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 471 141

Habitats NatureScope[R] Kit

Eva Emerson

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
- Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

S. Stowell

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

SE 067 005

BEST COPY AVAILABLE

SEQUOIA05

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

S. Stowell

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

NATIONAL WILDLIFE FEDERATION®
www.nwf.org™

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

NatureScope® Kits

This kit is an integral part of the National Wildlife Federation's education programs. As a national leader in environmental education, National Wildlife Federation produces innovative programs, engaging publications and world-class television and film productions to further its mission.

Some of the education program's highlights include:

- Educator workshops and curricula on topics as diverse as habitat, wolves, water, wetlands, bears, smart growth, endangered species, northern forests, and prairies.
- *Ranger Rick*, *Your Big Backyard* and *Wild Animal Baby* children's magazines.
- Nationally recognized programs such as the Backyard Wildlife Habitat™ and Schoolyard Habitats® certification programs, educator workshops, and NatureLink® outdoor programs for youth and teens.
- Giant screen format films on wildlife topics, such as *Whales*, *Dolphins*, *Wolves* and *Bears*.
- Wildlife television shows for children and adults.

For more information about NWF's education programs, visit the NWF web site at www.nwf.org. You can also email your local education representative at [your state's postal abbreviation]-ED@nwf.org (for example: the representative for California can be reached at CA-ED@nwf.org). Or, you may phone toll free 1-800-822-9919.

Who Should Use This Kit

This Naturescope Kit is designed for K-8 educators working in traditional and non-traditional classrooms with the goals of increasing awareness of the ways habitats work and why they are important. It is also aimed at educators who may want to prepare themselves and their students for creation of a Schoolyard Habitats® site on schoolgrounds.

How to Use This Kit

This kit introduces basic concepts of habitat through challenging and engaging interdisciplinary, hands-on activities. These activities build upon one another, leading students and educators along the path of awareness, discovery and action, with the culminating action resulting in the creation of a schoolyard habitat. The Schoolyard Habitat planning guide module in this kit offers a step-by-step unit for anyone who wants to take real action to help restore wildlife habitat to a nearby backyard, schoolyard or neighborhood.

To maximize comprehension and impact, we recommend using the kit as a supplement to a unit of study on ecosystems. Individual activities can easily be used to enhance other units as well; they are all aligned with National Science Education Standards. However, the guide is also designed to function as a stand-alone introduction to the topic of habitat.

We encourage you to introduce the service-learning project outlined in the Schoolyard Habitats® Planning Guide as a way to motivate and engage your audience in the activities that build up to the project.

Components of This Kit:

Kit Tips Module

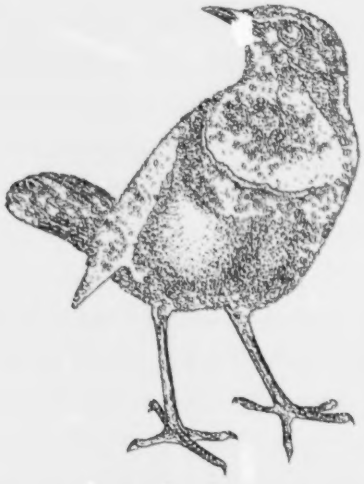
This section offers suggestions for using this kit in classrooms and in informal settings, such as camps, weekend programs, museums and zoos. Users will also find general tips on creating a inclusive setting to make activities accessible to all students and how to facilitate learning in the outdoors.

Background Module

This section provides content and background information to prepare educators to guide their audience through explorations of the natural world.

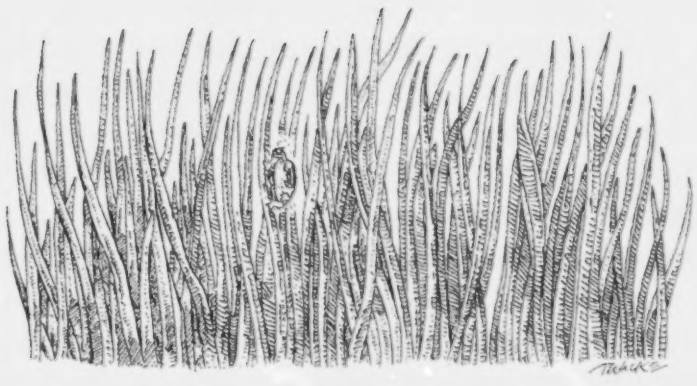
Activity Module

This section contains 15 activities designed to spark learner interest and motivate learning through hands-on explorations. Activities include indoor and outdoor experiences, individual and cooperative learning opportunities and emphasize multi-disciplinary exploration to challenge and encourage creativity and thinking skills.



Activities are designed to be adaptable for all age levels (K-8); the most appropriate grade levels are listed first, followed by those (older and younger) for which specific adaptations are provided. Each activity includes a summary, subject areas explored, skills developed, approximate time the activity will take, materials needed, learning objectives, tips on preparing, procedures for doing the activity and extension opportunities. Suggestions for creative assessments are also included. Each activity is correlated to National Science Education Standards in a matrix at the end of the activities section. Many of these activities can be adapted to particular regions, which will help make them more relevant to your audience.

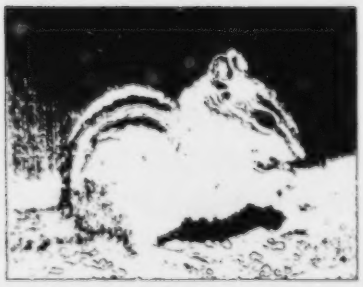
Using the activities section will provide a solid base for understanding of habitat concepts, how plants and animals use a habitat, the role of the physical environment and the living community in a habitat, habitat loss and restoration. In the Schoolyard Habitats® Guide module, students are challenged to create a wildlife habitat of their own.



Schoolyard Habitats Guide Module

This section outlines how your audience can take action to help wildlife by designing, creating and maintaining a National Wildlife Federation certified Schoolyard Habitats site. This environmental action and service-learning project helps your audience apply concepts learned in previous sections in a real-world context, encouraging them to go one step further in understanding the complex issues surrounding habitats, the environment and land-use.

Activities in this section help educators and students plan their habitat site step by step. Tips on building community support, fundraising and organizing the project as well as extensive resources provide more project support for schools, informal institutions, and programs. We have also included national education standards supported by the project and suggestions for creating a site accessible to all.



We hope this Naturescope Kit will engage and encourage everyone to appreciate the natural world around us and take action to help conserve it.

Credits

Naturescope Kit Developers:	Eva Emerson NWF Education Staff
Writer:	Eva Emerson
Editors:	Frances Nankin Kelly Trigger Stephanie Stowell Sharon Katz Cooper
Vice President, Education:	James L. Stofan
Director, Classroom Programs:	Bill Street
Sr. Director, Education Publications:	Donna Johnson
Illustrators:	Jennifer DiRubbio Patricia Wynne
Design:	Stetson Turner Design

Reviewers:
Craig Tufts, Julie Totaro, Tracie Beasley, David Heath

NWF Executive Staff:

President and CEO:	Mark Van Putten
General Counsel:	Eileen Morgan Johnson
Sr. Vice President & CFO:	Lawrence J. Amon
Sr. Vice President, Conservation Programs:	Jamie Rappoport Clark
Sr. Vice President, Constituent Programs:	Natalie S. Waugh
Staff Director:	Wayne Schmidt

NWF Vice Presidents:
Dan Chu, Robert S. Ertter, Carole S. Fox, John H. Giesecke, Philip B. Kavits, Jaime Berman Matyas, Thomas F. McGuire, Susan Rieff, James L. Stofan, Carolyn Waldron

Senior Advisors:
Barbara J. Bramble, Tom Dougherty, Douglas B. Inkley

A special thanks to the Wege Foundation for their generous support of the Schoolyard Habitats® Program

BEST COPY AVAILABLE

National Wildlife Federation
11100 Wildlife Center Drive
Reston, VA 20190-5362

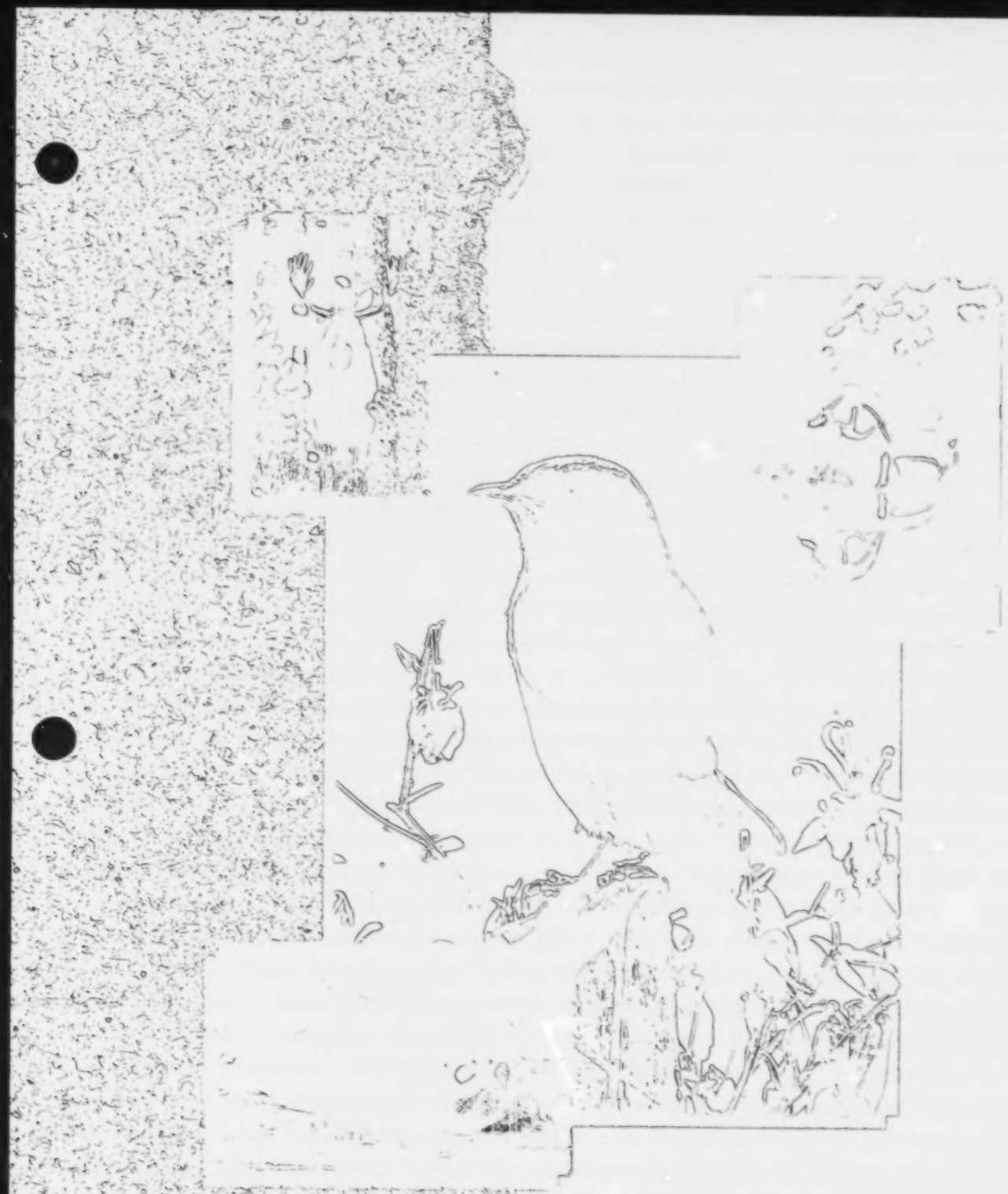
(800)822-9919
www.nwf.org

The mission of
the National Wildlife Federation is to
educate, inspire, and assist
individuals and organizations of diverse cultures
to conserve wildlife and other natural resources
and to protect the Earth's environment
in order to achieve a peaceful, equitable,
and sustainable future.

As America's largest
member-supported conservation group,
NWF leads grassroots efforts to safeguard
wildlife, wild places and the natural resources
on which we all depend.

The National Wildlife Federation has been
a leader in environmental education
for nearly 65 years.
From our Schoolyard Habitats® program
and teacher workshops to
Ranger Rick *magazine and our award-winning*
television shows and films,
NWF's dynamic education efforts reach out
to help people discover, experience and connect
with the wild in our world.

For more about NWF's education programs,
visit us at www.nwf.org.



NATIONAL WILDLIFE FEDERATION®
www.nwf.org™

BEST COPY AVAILABLE

Kit Tips

Contents

Using the Kit in the Classroom 1
Using the Kit in Informal Settings 2
Tips for Teaching in the Outdoors 3
Field Trips and Safety Considerations 5
Making the Program Inclusive 7
Disability Categories 8
Adapting activities 9

Using this Kit in the Classroom

- ❑ Create a mural or display in the classroom. Add sounds and smells of familiar habitat plants and animals to get students excited about working on the unit.

- ❑ Place a variety of books on animals, plants and habitats around the classroom for independent reading.

- ❑ Use a bulletin board to post student artwork, reports and questions as they progress through the unit.

- ❑ Ask students to read newspapers, magazines or look online for recent stories about habitats, habitat loss or endangered species. If they find one, they may cut it out and share it with the class.

- ❑ Throughout the unit, have students keep a journal where they can write down their impressions and feelings about what they've learned and activities they have done. They can also include a section in which they can write down any wildlife they see while working on the unit. Local wildlife sightings can be used as a starting point for activities (especially those which ask students to focus on one plant or animal), class discussions or when the class begins planning its Schoolyard Habitats site.

- ❑ Students will work in small groups in some of these activities. If students have never worked in groups, it is worthwhile to introduce the idea of cooperative learning groups and clarify what each student is expected to do in a group project. For younger students, you might try a practice group learning activity to familiarize them with this format.

- ❑ For a broader perspective on issues explored in this kit, ask professionals and others with varying view points to come speak to your class.

- ❑ Consider including informal education settings as part of using this kit. Trips to botanical gardens, zoos, natural history museums and other institutions can provide memorable, exciting, and highly educational experiences related to habitats.

- ❑ If you plan to create a Schoolyard Habitats site as part of your overall lesson plan, send letters home to parents when you start teaching this unit to enlist their support. Later, you will need to identify parents interested in helping with the Schoolyard Habitats project.

Using this Kit

These activities can be easily used or adapted for an informal learning setting.

- ❑ If you have limited time with your group, prepare the activity one to two weeks before students are scheduled to do it. For example, if the activity requires plants, instead of waiting for a plant to grow have seedlings prepared ahead of time. If you offer sequential classes (such as one each week) materials the first class prepares can be kept to use for the next class.

- ❑ For activities that ask students to do extensive research, summarize key information before students arrive. Or, make the research process more active by conducting it at a zoo, museum, aquarium or informal institution.

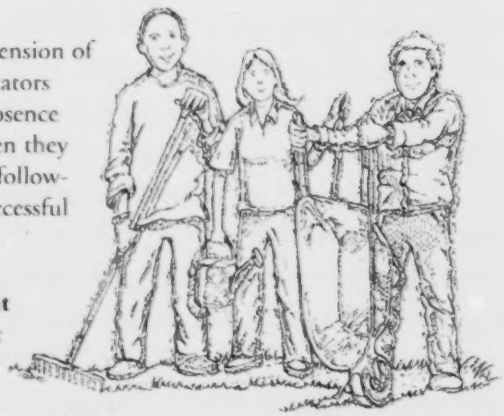
- ❑ Informal settings often emphasize **doing** over listening or seeing. Use activities that involve the most hands-on opportunity.

- ❑ Discuss relevance of the kit's ideas and activities in students' own lives.

- ❑ Many of these activities are well-suited to family or parent-child classes. Working in groups with different ages can facilitate learning, as each member brings a different perspective and life experience. Group learning can also give students a valuable and different social experience and allow parents a chance to model learning with their child.

- ❑ Whenever possible, allow students some control over the learning process within an activity. Students who come up with methods and/or resources to answer their own questions are far more enthusiastic about their discoveries than are those who are given everything already planned for them.

General Tips Teaching in the Outdoors



The schoolyard can be a valuable extension of the indoor classroom, but some educators may initially feel uneasy about the absence of the four walls and chalkboard when they bring their classes outside. Keep the following suggestions in mind to assure successful experiences with students outside:

1. Set clear expectations for student behavior before going outdoors. Set rules for positive outdoor behavior prior to your first outdoor venture with students. Students need to understand that "outside" is a classroom too. Involve the students in the rule setting, just as you may already do when setting indoor rules.

2. Plan carefully. The schoolyard can be a place for quiet contemplation, active play, intense observation, questioning, independent work, group projects, hard work, and relaxation. Before taking students outside, it is important to decide which type of experience(s) you want to provide on a given day. Be sure to communicate this to students indoors: discuss where on the schoolyard the class will be working, how long they will be outside, what they will be expected to do, etc. before walking outside. Providing the background or first steps of an activity while in the classroom might also help those students unaccustomed to schoolyard classes focus. The time indoors needed to prepare students for a successful schoolyard field trip will decrease quickly over time.

3. Keep the first experiences simple. Keep plans simple the first few times you teach outdoors. Don't worry if you do not finish all that you have planned. Both you and your students need time to adjust to this new classroom environment.

4. Recruit teachers, parents and/or volunteers to help. While not always possible or necessary, having an extra adult or two with you when teaching outdoors can be very helpful. Consider working with another teacher and taking both classes out together.

BEST COPY AVAILABLE

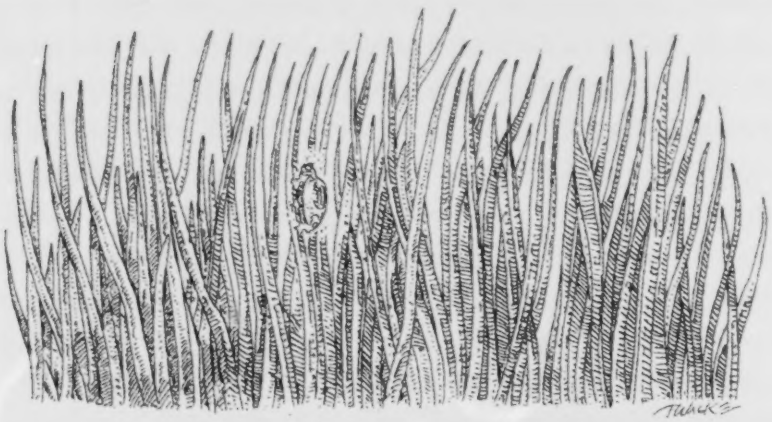
5. Visit your lesson site. Become comfortable with the site you will be teaching in prior to taking your students outside. Where can the whole group gather? Where can small groups work together? Are there areas that illustrate concepts you plan to teach? What are the benefits and challenges of the site?

6. Decide on a way of getting students' attention outdoors. Have a clear signal for getting everyone's attention and gathering together. Practice it! Keep the sun in your eyes (out of students' eyes), the wind at your back (so your voice carries to your students) and stand in the center of a circle or line of students when sharing (so all can see).

7. Be a positive role model. Show enthusiasm, excitement and a positive attitude in all that you do. Make sure your students can hear this in your tone of voice and can see it in your body language. Create a sense of adventure or mystery. Enjoy what your students find; look at what they are showing you and share these discoveries with the whole group.

8. Allow students the opportunity to explore their surroundings. To be safe, comfortable and excited about learning in the outdoors, students need time to explore the areas in which they will be learning. Many of today's children do not have the opportunity to explore outdoor areas and need the opportunity to adjust. Emphasize observation.

9. Learn to use "teachable moments." Nature's lessons will often be more compelling than the task at hand. Be flexible and remember that in the natural world everything is connected to everything else. Let the students experience nature in the moment and then link that moment back to your lesson.

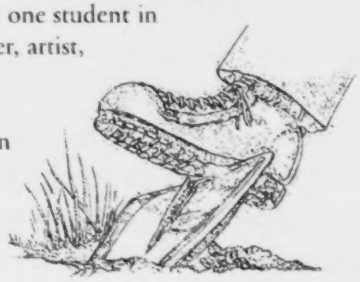


10. Design lessons that flow. Design your lesson so that activities transition your students from idea to idea and indoor to outdoor behavioral expectations. Identify an introductory activity to excite your students and acclimate them to the outdoors. Develop a list of fun strategies for moving your students from place to place, and use a closing activity to review what students have learned and to prepare them for returning indoors.

11. Become a "guide," "explorer," and "learner." You do not, should not, could not know everything about nature! Don't let a lack of knowledge slow you down. Create an atmosphere of investigation and share your excitement about learning new things. If you are excited about learning then your students will be excited as well! Telling a student "I don't know, but lets look it up!" is a great way to encourage students to guide their own learning.

12. Ask guiding questions. Avoid giving direct answers to student questions. Help students discover answers on their own. If a student wants to know the name of something, ask him or her questions such as "How large is it?" "Where does it live?" or "How do you think it avoids predators?"

13. Engage all students during all activities. Students that are actively engaged in a lesson are less likely to have behavior issues. Give each child a role or task for each activity. For example, if your students are observing pollinators, have them work in small groups and have one student in each group take on the following roles: observer, writer, artist, and identifier (uses field guides).



14. Use backpacks to manage supplies. Students can carry their own set of supplies in their backpacks. Backpacks allow students to keep their hands free for safer walking and participation in activities, and eliminate the chore of keeping track of loose items. Backpacks also allow students to take water bottles, layers of clothing, raincoats and anything else they might need to make their outdoor experience a pleasant one. Encourage students to take water bottles with them if they are going to be outside for more than 20-30 minutes at a time. Light snacks are also a good idea if your students are going to be outside for a long time, hiking or engaging in physical activities such as running games, building bird boxes or gardening. On a hot day, a short rest in the shade can dramatically improve students' attitudes and reduce behavior problems!

Safety Field Trip Considerations

1. Be aware of any allergies, medications, and special precautions necessary for the safe involvement of all students.

2. If participants explore an area by turning over rocks or logs, make sure they do so carefully. In areas where poisonous snakes may live, students and leaders should always turn rocks and logs over toward themselves, grasping the edge of the rock or log furthest from them. That way any alarmed creatures can escape in the opposite direction. Return rocks or logs to their previous positions when you are finished looking.

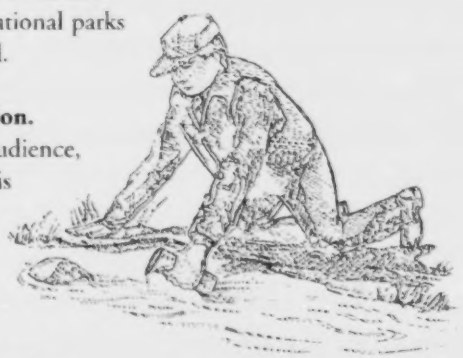
3. When bees or wasps approach, encourage calmness and little movement. Usually, when bees and wasps find out that the sweet-smelling person they landed on is not a flower, they will move on. When people swat at them, on the other hand, they may attack.

4. Encourage long pants in areas where deer ticks are abundant.

5 If poison ivy, poison sumac, or poison oak grow in your area, teach students to recognize, identify and avoid contact with these plants.

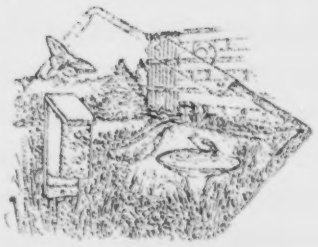
6. Bring all materials and equipment necessary for activities, snacks, first aid and safety. Include sunscreen and water in your own supplies.

7. Before collecting any materials from a site, obtain permission from the person or organization that owns the land. Materials from state or national parks must stay where they are found.



8. Provide adequate supervision. Depending on the age of the audience, one adult to 8-10 participants is recommended. For a children 6-8 years of age, the recommended ratio is 1:6. Depending on the needs of participants with disabilities, a smaller ratio may be required, such as 1:4 or smaller. Some individuals may need 1:1 supervision.

Making the Program Inclusive to All



As educators, it is important to include all participants, regardless of ability level, in the learning experience. Increasingly, formal and non-formal education settings are serving inclusive audiences. An inclusive audience is one that includes participants with and without disabilities. An inclusive program is one that strives to create a unified learning experience that engages all participants, instead of creating separate programs for different audiences.

To facilitate inclusion with the activities in this kit, following are general adaptation guidelines for the four major disability categories: motor, learning/cognitive, hearing, and visual. These guidelines provide information and ideas that will enable educators to confidently and comfortably engage all participants. In addition, by incorporating these adaptations into activities, educators will enable all youth and teens to participate to the best of their ability.

When facilitating activities with an inclusive audience, it may be helpful to involve parents and/or other educators whenever possible. Try to incorporate the adaptations/techniques that are used at home or at school into the activities and subsequent outdoor experiences. More often than not, adaptations are transferable from one learning situation to another, and many tools or strategies used in the participants' homes or classrooms can be applied to the outdoors. Request that participants bring any adaptive equipment they might utilize to ensure the fullest level of participation. This exchange of information can be accomplished in a variety of ways, such as requesting information up-front on a registration form or having a parent orientation meeting prior to the program starting.

These adaptation guidelines are general enough to target a broad base of individuals with disabilities and should not be viewed as a definitive list of accommodations available to educators. As with all of us, children and teens with disabilities are individuals with a variety of strengths, needs, interests, and learning styles. Some participants with disabilities will need no adaptations. Modifications should be made on an individual, as-needed basis. This basic premise should be your guide when adapting activities. When possible, individualize adaptations to meet individual participant's needs and focus on individual strengths and abilities. Be creative, flexible, and open for suggestions. Remember that not everything works for every person. What matters is that you are willing to try until you reach the best result, which is to have each participant exploring and experiencing nature to the best of his/her individual abilities.

Disability Categories

The following adaptations address four broad disability categories. Some disabilities may affect only one category or all four. It is also important to note that some individuals may have a combination of disabilities and that adaptations should be considered for each of the disabilities. A brief description of the four disability categories is given below.

Hearing Disabilities

Hearing impairments may result from problems in any part of the ear or the hearing center of the brain. Hearing loss is categorized as mild, moderate, severe, or profound. Individuals who are deaf or hard of hearing will use different method(s) of communication and/or communication equipment including Manual (sign language), Oral (speech/lip reading), and/or assistive listening devices. In addition to individuals who are deaf or hard of hearing, some conditions that may result in hearing loss include brain injury, Cerebral Palsy (CP), cleft palate and cleft lip.

Learning/Cognitive Disabilities

This is a broad category that focuses on the perception and processing of information and/or level of developmental functioning. Many learning/cognitive disabilities are not readily noticed, but can become apparent during the learning process. A person with a learning or cognitive disability may have one or more associated conditions, including Attention Deficit Disorder (ADD), Dyslexia, Autism, Cerebral Palsy (CP), Down Syndrome, and other forms of Mental Retardation (MR).

Motor Disabilities

This category represents physical disabilities related to the motor function of either the upper or lower extremities, or both. Some individuals with motor disabilities may require assistive mobility devices such as wheelchairs, walkers, or canes. Other individuals may require adaptive equipment such as tabletop scissors or tools with built-up handles to complete activities, while others may require no assistance at all. Conditions that may result in motor disabilities include spinal cord injury, Multiple Sclerosis (MS), Muscular Dystrophy (MD), and Cerebral Palsy (CP).

Visual Disabilities

Individuals with visual disabilities possess varying levels of sight. Many individuals can perceive some degree of light and detect motion around them. Others can see blurs of images or bright colors. Ask individuals with visual impairment what he/she can see and how best to present information to him/her. It is important to note that not all individuals who are blind know Braille. Visual impairments or blindness are divided into two major categories, Total Blindness and Low Vision.

Adapting Activities
General Activity Adaptations

The following is a list of general guidelines for presenting information to individuals with certain corresponding disabilities. Below are common activity adaptations and suggestions for each disability category.

Hearing Disabilities

For participants with hearing disabilities, the most common adaptations relate to communication. Each of the suggestions below are designed to facilitate the most effective two-way communication possible.

❑ Use a sign language interpreter. Give the interpreter a copy of the activity with key words and concepts highlighted before the session. An invaluable adaptation: check with local colleges and organizations for people who are deaf or hard of hearing, or social service agencies to find sign language interpreters in your area. You can also ask a parent to be an interpreter. Provide the interpreter information ahead of time so he/she can be fully prepared. Remember that environmental concepts are not necessarily common signs; the interpreter will need time to prepare.

❑ Always face participants with hearing impairments when speaking to accommodate lip readers. Make sure to keep all objects away from your mouth when speaking; do not exaggerate mouth movements.

❑ Work with the interpreter to learn common signs to use during the program such as "stop," "good job," etc.

❑ Provide directions in writing. (Allows participants to independently check if they are on the right track.)

❑ Seat participants who are deaf or hard of hearing near the front of the group in a semi-circle formation.

❑ Position yourself and the interpreter so the participants can see you.

❑ Use pictures, examples, and hands-on interactions to help illustrate your points. Incorporate visual learning into sessions whenever possible.

❑ Check for understanding when presenting new concepts or ideas.

❑ When outside, establish a designated check-in point and time for safety purposes.

❑ Use a flag or hand signal to interrupt or end an activity.

❑ When possible, provide a note-taker.

❑ Encourage participants to be active in all discussions and ask questions. Have participants raise their hands to ask or answer questions. Check with each participant to see if they are most comfortable interacting with the group by speaking, using the sign language interpreter, or writing things down.

❑ Plan for extra time as needed. This will give the interpreter and participants ample time to communicate.

❑ Reinforce positive behavior and provide encouragement.

❑ Maintain good eye contact. Check with participants throughout the activity to see if they have any questions.

❑ Provide assistance as needed.

Learning/Cognitive Disabilities

❑ Present information in a clear, concise manner. Avoid using too many words to present concepts; simplify. Make sure the pace is appropriate and that the vocabulary used is on the participants' level of comprehension.

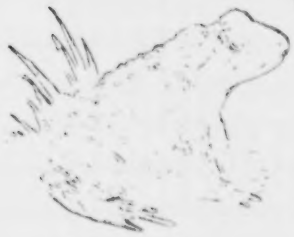
❑ Break activities down into steps. Focus on 1 to 2 steps at a time. By doing so, you will not overwhelm participants; activities will be more manageable.

❑ Minimize distractions in classroom/setting to decrease over-stimulation.

❑ Plan for extra time as needed. This can mean a few minutes or several sessions. Some activities may require two or three sessions for individuals to complete based on their processing and/or ability level.

❑ Use pictures, examples, and hands-on interactions to help illustrate your points and explain directions. Incorporate visual learning into sessions whenever possible.

❑ Check for understanding when presenting new concepts or ideas and when giving directions.



❑ For written word assignments, use pictures and a few basic words for participants who have difficulty reading, or who read on a lower level. Allow participants to respond by drawing when appropriate. If possible, provide small tape recorders for participants to record information.

❑ Have resources available that match participants' reading level; use picture books as appropriate.

❑ Allow for extra processing time when waiting for participants to respond orally.

❑ Use repetition. (Many individuals have trouble retaining information or learning a concept after only hearing it once.)

❑ Allow for questions and answers as you go.

❑ Encourage participants to be active in all discussions and ask questions. Let them know you are interested and value their input and participation.

❑ Pair up participants to complete the work as needed. Some participants will require a partner only occasionally to complete an activity successfully, others for each activity. This partner can be a peer, staff, or volunteer. Encourage the partner to ask the participant how to be of assistance and to allow the participants as much independence as possible.

❑ Allow for structured breaks. (This lessens over-stimulation and frustration.)

❑ Allow participants to stand part of the time. (This provides an outlet for excess energy and reduces frustration.)

❑ Reinforce positive behavior and provide encouragement.

❑ Provide assistance as needed.

Motor Disabilities

❑ Seat participants who use wheelchairs so that they can easily see the facilitator and any pictures or examples.

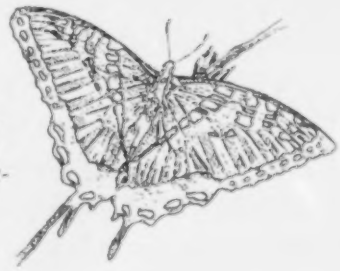
❑ Adjust the height and angle of the work surface as needed. (Examples: Use a reading stand or a stack of books, etc. to raise materials to the level participants need. Some participants may have adaptive equipment that they already use to accomplish this.)

❑ For participants with limited muscle strength or coordination of the hands, build up the handle of pencils/markers/paint brushes with foam, putty, tape, or bandage material as needed. (The individual will determine the thickness of the material. Some participants may have pencils or pens already adapted. Others may have cuffs, straps, or other assistive devices that enable them to hold traditional items.) Use large crayons for younger participants. Use large glue sticks instead of bottled glue. Provide adaptive scissors.

❑ Secure items to the work surface for individuals who have spasticity or poor muscle control to pre-

vent spills, etc. (Examples: Taping a worksheet to the desk; using a clipboard to hold a worksheet; securing a cup to a work surface with putty/clay.)

❑ Encourage participants to use any adaptive equipment necessary for them to fully participate in all activities. If you do not know how a particular device works, have the participant or a parent demonstrate how it works.



❑ Pair up participants to complete activities as needed. Some participants will require a partner only occasionally to complete an activity successfully, others for each activity. Instruct partners on how to assist participants with motor-related disabilities as needed (e.g., cuing for safety, getting around barriers, etc.). This partner can be a peer, staff, or volunteer. Encourage the partner to ask the participant how to be of assistance and to allow participants as much independence as possible.

❑ Choose a largely accessible site for all activities (e.g., as level as possible, does not flood, has a minimal number of obstacles, etc.). Of course, this means within reason. Not every outdoor site will be completely accessible. Stake out the area before the group arrives to map out any safety concerns, obstacles, etc.

❑ Plan for extra time as needed.

❑ Provide assistance as needed.

Visual Disabilities

❑ Give verbal directions very clearly before starting.

❑ Use hands-on, concrete examples to help illustrate points. Allow participants time to touch and explore examples. Incorporate items that can be heard and smelled.

❑ Check for understanding when presenting new concepts or ideas.

❑ Have a variety of magnifiers available. (Many participants will have their own. There are a variety of sizes, styles, and strengths available, from 3x up. Magnifiers are available in illuminated and non-illuminated forms.)

❑ If possible, have resource materials available in alternative formats (e.g., Braille, large print, or audio cassette).

❑ Consider individual lighting needs. Some individuals require brightly lit areas, while others are light sensitive. Talk to participants and see what

best meets their needs. For participants who need an area brightly lit, use a lamp to illuminate the work surface. If possible, point the light at the item to be illuminated.

❑ Keep the discussion lively and interactive. Involve the participants as much as possible. Encourage participants to experience nature with all of their senses. Be very vivid in descriptions of items, actions, and events.

❑ Let participants know when they are doing a good job and that you value their input; encourage their efforts.

❑ Create a large print version of any worksheets or materials for participants with low vision. Use large (at least an 18 point font) block, black letters on white paper. Enlarge all photographs. Keep worksheets simple and uncluttered. It may be necessary to spread information over two or three pages.

❑ Create a Braille version of any worksheets or materials for participants who are blind. (Check with local school systems, libraries, organizations for people who are blind or have low vision, or parents to obtain a Braille typewriter, computer program, and/or label maker.)

❑ Create enlarged maps that are outlined in black and thick, raised lines of glue for participants to feel. Maps need to be simple and cover a small area. It may be necessary to make a series of maps to display large areas.

❑ Make tactile diagrams or other instructional displays out of different fabrics (e.g., felt, corduroy, satin) or items (e.g., rice, beans) to further engage participants.

❑ Allow participants to make items out of clay or other objects (e.g., cotton balls, craft sticks) instead of making a drawing.

❑ Pair participants up as needed. Have the partner act as a sighted guide and give verbal directions or coach throughout the activity. Examples of useful assistive techniques include: giving verbal warnings about obstacles, providing clear directions (using compass directions to help with orientation), not rushing, etc.

❑ When outside, give each participant and their partner adequate space to explore. Space out starting times. Mark off the trail or area to be used with a guide string.

❑ Allow extra time as needed.

NATIONAL
WILDLIFE
FEDERATION®
www.nwf.org™

National Wildlife Federation
11100 Wildlife Center Drive
Reston, VA 20190-5362

(703)438-6100
www.nwf.org

Background

NATIONAL WILDLIFE FEDERATION
www.nwf.org

Welcome to Habitats!

A few of the world's smallest birds live among the world's tallest trees in the redwood forests of California. There, 4-inch Anna's hummingbirds feed on nectar-rich flowers and insects below the 300-foot redwood giants, squeaking loudly whenever a rival comes too close. Coastal fog leaves a blanket of dew on the redwood's needle-like leaves, providing a refreshing drink for the birds. The trees also provide cover. Hummingbirds build nests in tree boughs, sheltering their young from weather and predators. This forest is the hummingbird's habitat – the place where it lives and gets what it needs to survive.

A habitat may be a duck's pond, a squirrel's city park or a meadow that's home to a mole and its maze of subterranean tunnels. A blue whale's habitat is as large as an ocean, while a fungus habitat may be as small as the roots of a single plant. A bird habitat may be high in an alpine meadow or low in a coastal marshland. A habitat may be wet like a rushing stream or bone dry like a desert. A habitat may be in the city, on a farm or in forested wilderness.

Habitat is where an organism makes its home.

What is a Habitat?

No matter its location, a plant or animal's **habitat** is critical to its survival. Today, more than 700 types of plants and animals in North America have been designated as endangered, meaning only a handful of individuals remain and the population appears dangerously close to extinction. In fact, habitat loss and degradation pose the greatest threats to North American wildlife. To save **endangered species** and to conserve the incredible diversity of living things on this continent, people must work to protect wildlife habitats. Learning about how animals and plants rely on their habitats and each other can help foster a sense of environmental stewardship needed to save our wild heritage.

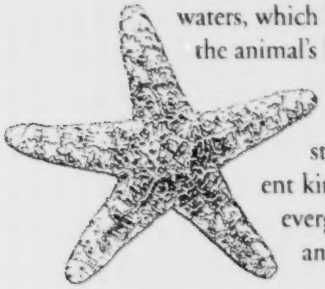
This Habitat background information provides educators with information needed to engage students in the study of habitats. It will help them find answers to questions such as:

- ❑ What is a habitat? What is an **ecosystem**?
- ❑ How do plants and animals interact?
- ❑ What are adaptations?
- ❑ What are the primary causes and effects of habitat loss?
- ❑ Why are healthy habitats important?
- ❑ What can we do to work towards the conservation and restoration of natural habitats?

We hope that you will encourage your audience to come up with their own questions and ways to begin answering them. Remember to go outside and enjoy your local nature, wherever you may be located. That alone may be motivation enough for beginning a study of habitats.

Habitat is a place where **organisms** get what they need to survive: food, water, cover and a place to raise young. In other words, a habitat is a plant or animal's home. A person's habitat might stretch from home (where there is water, cover and a place to raise young), to the supermarket (where he or she gets food) and to the workplace. All the places people go to get what they need to survive can be considered part of their habitat!

Different living things have different needs for food, water and cover, so each kind of animal or plant has a specific kind of habitat. For example, some sea stars live in rocky tidal pools along the Pacific coast. The rocky tidal zone forms the main part of the sea star's habitat (sea star larvae float through coastal waters, which is also considered part of the animal's habitat). A moose, on the other hand, has very different needs from a sea star and lives in a very different kind of habitat – like the evergreen forests of Alaska, among other places.



Scientists who study how an area's physical environment and living things interact are called ecologists ("eco" is derived from the Greek "oikos" meaning home). They divide their studies by scale, from smallest to largest. The smallest unit ecologists study is an individual organism, including its habitat and niche. Ecologists may also study a **population** of organisms of the same species. The populations of plants and animals that live near each other in a particular habitat make up the living community.

Both the physical environment and the living community of plants, animals and other organisms determine an ecosystem. Each ecosystem has a characteristic physical environment, including its climate and altitude, which produces a dominant type of vegetation. For example, eastern temperate forests tend to have cold winters and wet, hot summers. Broadleaf trees like oak and maple live well in these conditions and, in fact, most eastern forests are defined by the mix of oak, maple, birch and other trees that grow there. These trees create a **canopy** that shades the forest floor and provides habitat for many creatures, such as gray squirrels, white-footed mice, white-tailed deer, blue jays and more. Desert ecosystems, on the other hand, receive little rain throughout the year and can only support plants able to tolerate dry conditions such as cacti and sagebrush, which in turn characterize the habitat for many other plants and animals.

In forests and all other ecosystems, plants and animals living there are adapted to their environment (they have inherited characteristics that enable them to survive there). Generally, plant and animal species have one kind of habitat that suits them best, though they may be able to find elements of their habitat in many different areas. For example, some sea urchins live in kelp forests, but also can be found in rocky tide pools. Other species, however, have very specific requirements of their habitat. Chalcid wasps, for example, are a group of insects so adapted to fig trees and vice-versa that neither can survive without the other. The wasps feed and reproduces in certain species of fig trees and these fig trees depends on the wasps as the only insects that can pollinate them.

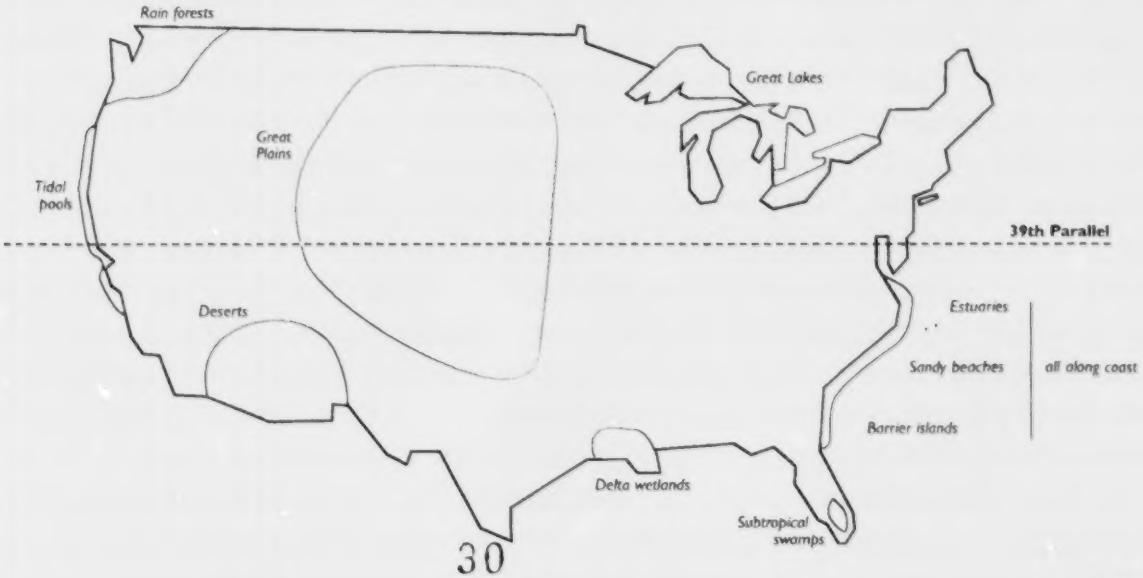
Many Different Kinds of Habitats

Even when two organisms (any kind of living things) have very similar habitats, their needs and how they meet these needs may be distinct, allowing them to live in close proximity to each other without close competition. Two birds, for instance, might live in the same tree but eat different foods, have different predators and have different tolerances to sunlight. The birds live in the same place, but do not fill the same role, called a **niche**. If organisms share the same niche, they may compete and limit the number of organisms that can live there. Competition, over a long time, may lead to greater animal and plant diversity as organisms carve out distinct niches.

North American Ecosystems

Trace the 39th Parallel across a map of the United States. Traveling from coast to coast along this latitude, you would pass through a surprising variety of North American ecosystems, containing countless habitats for wildlife. The journey would lead you through California's **chaparral** and the sands of the Mojave Desert, on to the evergreen forests of the Rocky Mountains, the mid-western prairies and finally arriving at the broadleaf forests of the east coast. All of these ecosystems contain a wide array of plant communities and physical environments, and thus support a great diversity of wildlife habitat.

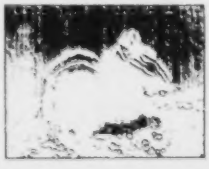
The 39th Parallel only provides a glimpse of the diversity of habitats found in North America. North of that latitude lie the wet evergreen forests of Washington and Oregon, the rare **temperate rain forests**. These **boreal forests** give way to arctic **tundra** further north in Canada and Alaska. South are the **deserts** of Arizona and New Mexico, the **wetlands** of Louisiana and the subtropical **swamps** of Florida's Everglades. On the western shore, rocky tide pools mark the meeting of land and sea, while the East Coast boasts sandy beaches, salty **estuaries** and **barrier islands**. Aquatic North American ecosystems include oceans, lakes, ponds, rivers and many kinds of wetlands.



Species in a Habitat

Although we rarely think of urban areas as 'wild places,' cities are parts of various ecosystems too. Rare and delicate ecosystems may sometimes be found alongside an abandoned railroad track, under the roaring jet engines of an airport, and in between city blocks. In the city, a park may be a squirrel's habitat, where it finds acorns to eat, water to drink and a hole in a tree to hide and raise its young. Across town, a skyscraper may provide a nesting place for a peregrine falcon, while the park may provide it with food and water.

What creates this diversity in habitats?
The diversity results from unique combinations of the physical environment and the living community. Physical factors play a key role, since the amount of rain, sunlight, temperatures and the type of soil largely determine the kinds of plants that can survive in an area. These factors change from north to south and with the presence of mountains or sea, among other features. In addition, all animals depend directly or indirectly on certain plants for food and shelter, and the presence or absence of these plants influences an animal's survival in a given habitat. Plant and animal species also affect each other and the physical environment. Depositing feces and urine, for example, may change chemistry of soil or water. A bee that pollinates a flower helps the flowering plant to reproduce.



The Physical Environment

Putting on a raincoat to stay dry. Turning up the air conditioner on a sweltering day. Wearing a hat to block the sun. These are all instances of human beings reacting to their physical environment. Wildlife, too, are affected by their physical environment, which determines in part the kind of habitat in which they live.

Species are adapted to live in a habitat with specific physical and chemical conditions. This includes weather (rainfall and temperature), soil (both the chemical nature and the supply of air and water available to plant roots), exposure to sunlight (sun or shade) and the composition of air (humans rely on a certain amount of oxygen in the air we breathe–that's why some feel out of breath when visiting a place of high altitude, where the air holds slightly less oxygen). Other parts of the non-living environment are also important in determining whether a plant or animal can survive in a given habitat. These include: wind, salinity (the amount of salt in

How Do Plants and Animals Interact?

the soil or water), geologic forms (such as mountains or rivers, which influence weather, and caves or rocks, (which some animals use for shelter), fire and other disturbances, amount of air dissolved in water (in aquatic habitats) and whether the soil, water or air has been polluted by significant levels of toxic substances.

Plants need sunlight, water and carbon dioxide gas to survive in their habitats. In addition, they require nutrients such as nitrogen and phosphorous to grow. Without sufficient amounts of these non-living factors, a plant would weaken and eventually die. All habitats must have both a suitable physical environment and the other plants and animals an organism needs to survive.

Many parts of the physical environment can become limiting factors when in short supply or in excess. Within a habitat, each species has factors that limit its growth or reproduction. In a desert, water – or the lack thereof – is a serious limiting factor to plant growth. Add water by irrigation, and plants grow more quickly. Stop irrigation, and growth returns to normal. For a tree seedling on the shaded forest floor, amount of sunlight may be what most limits the seedling's growth. Other examples of limiting factors include temperature, supply of minerals in soil, land for territory and the availability of food and nutrients. Temperature and other factors become limiting to growth and/or reproduction when they approach the limits of what a living thing can tolerate.

Food Chains and Food Webs

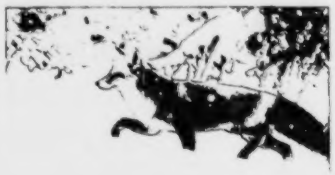
Most organisms depend on other living things to meet their needs for food and often for shelter. Taking in food is critical to survival. From food, living things get the energy they need to be alive. Plants get their energy from the food they make through the process of **photosynthesis**, and animals get their energy by eating plants and other animals. The path through which energy and nutrients pass from one living thing to another is called a **food chain**. All living things are part of at least one food chain, which includes species that live in the same or overlapping habitats.

Green plants represent the first step in most food chains. During photosynthesis, plants (and a few types of bacteria) absorb energy from sunlight and use that energy to turn water and carbon dioxide gas into food. Plants are considered producers in an ecosystem because they produce the food that supports other living things in a food chain. Almost all animals rely, either directly or indirectly, on plants for food.

Animals that eat primarily plants are called **herbivores,** or primary **consumers**, and repre-

sent the next link in the food chain. Animals called **carnivores**, or **secondary consumers**, eat herbivores and form the next level of the food chain. Some animals eat both plants and animals and are called **omnivores**. Many food chains end with a **tertiary consumer**, or a top predator, which eats secondary consumers.

Few food chains contain more than six species, since a large percentage of energy is lost at each transfer from the organism that is eaten to the one that eats it. For example, a rabbit feeds on grass for energy and then spends most of this energy digesting, moving and controlling its body temperature. The fox that eats the rabbit gets only a small fraction (about 10 percent) of the original energy stored in the grass. Because relatively little energy is passed from one link in the food chain to the next, food chains aren't usually that long.



Energy loss also explains why those at the top of the food chain, top predators, are generally rare. Top predators like wolves and sharks must eat many smaller animals to get enough energy, and so a large population of wolves would not be able to find enough food. Primary consumers are much more common than secondary consumers, which are in turn more common than tertiary consumers.

Organisms are rarely part of just one food chain. A collection of food chains in a community form a living network called a **food web**. **Decomposers** are a part of all food webs and include microbes, fungi, and insects that break down dead plants and animals, returning essential nutrients to the soil. This process ensures that nutrients are available again for use by plants and microbes.

Predator and Prey

Beyond providing food-energy for the predator, predator-prey relationships help keep populations of both species in check. When a predator is removed, prey population may grow out of control, beyond the ability of the habitat to support them. For example, in Arizona in the early 1900s, hunters eliminated huge numbers of wolves, mountain lions and coyotes – all top predators that ate mule deer – in the area . Without predators, the mule deer population grew from 4,000 individuals in 1907 to more than 100,000 in 1924. The huge population of deer stripped their habitat of all the leaves, plants and other greenery they used as food. With food scarce, many deer starved and fewer were able to reproduce. By 1939, the deer population had declined to just 10,000 individuals.

The availability of prey also controls the population of predators. For example, the Steller's sea lion has faced serious population declines at least in part due to the large amount of fish removed by Pacific Northwest fisheries.

Other Interactions

Food webs aren't the only kinds of interactions between species in a habitat. Although you may not think about it, each time you seek shade under the boughs of a tree, you interact with the tree. Plants and animals in a community depend on each other to meet needs other than food, such as shelter, places to raise young

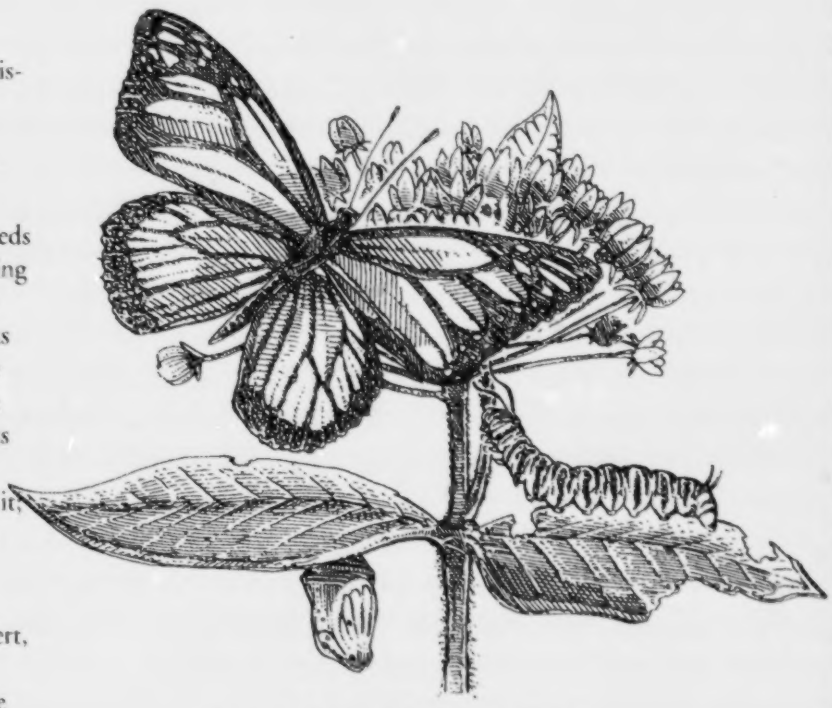
and assisting in plant **pollination** and the distribution of seeds.

For a view of these other kinds of relationships, just look at a saguaro cactus. In the desert, mice and rabbits help disperse the seeds of the saguaro cactus to new locations. During its first years of life, a saguaro cactus needs shaded habitat. To meet this need, the cactus depends on other plants, such as a mesquite tree to protect it from the hot sun while the root system develops. Later in life, the cactus provides shelter (and food) to many other organisms. Gila woodpeckers build nests in it; once vacated, the nest may provide a home for elf owls, lizards, insects or spiders.

Like the saguaro cactus in the Sonoran Desert, prairie dogs are a **keystone species** on the short grass prairie. They live in 'towns' made up of hundreds of underground burrows and tunnels in the grasslands of the American West. Burrows are built with chambers set aside for sleeping and storing food. Abandoned burrows provide shelter for many other prairie critters, including prairie rattlesnakes, black-footed ferrets and burrowing owls.

Life Cycles and Habitat

Many organisms have different needs as they go through the stages of their life cycle, especially organisms like butterflies that undergo **metamorphosis**. Butterflies look drastically different as adults than they did when they were young, as caterpillars. Their needs for food, water and cover also change. In these cases, the habitat of the young, or larval stage, of a species can be extremely different from the habitat of an adult. In this way, some species may have two or more distinct habitats for the different stages in their lives.



Specialists and Generalists

Scientists consider the members of a species **generalists** if they can live in a wide range of places and they can eat a wide variety of foods. **Specialists**, on the other hand, include species that have a narrow niche and have very specific habitat requirements. Generalists are better able to adjust to changes in the environment by finding a new source of food or cover. Populations of specialists grow when the resources they rely on are available, but may not be able to survive if changes threaten their only food, cover or nesting resource.

What is the quintessential generalist?
The raccoon! They are generalists found in many different ecosystems. Raccoons live in ecosystems as diverse as woodland, grassland, wetland, desert and seashore, not to mention the alleys of

What Are Adaptations?

inner cities and suburban lanes. They live throughout North America – from Canada to Panama. What are their secrets for success? For one, they eat a varied diet, and can find nutrition from many different sources. Raccoon diets include plants, nuts, fish, rodents or the leftovers found in garbage cans. This flexibility means that if one source of food disappears, raccoons are still able to find another. For cover, they do not have specific needs. Any hole or crevice will do. Raccoons have been known to make hideouts in pipes, tree holes and small rock hollows. Many plants are generalists, too. The red maple, a "super-generalist," grows in a variety of environmental conditions – wet or dry, rich or poor soil, sun or partial shade – allowing it to aggressively expand its habitat. In the 1900s, the maple began replacing oaks and other trees, as it

moved from the southeastern forests into the mid-Atlantic area and into the upland forests of the Northeast.

What about specialists?

By contrast, monarch caterpillars depend on a single group of plants, the milkweeds, for food. By specializing on milkweeds, the monarch has evolved the ability to eat plants that other insects find poisonous. As a result, there is limited competition for milkweed leaves. But this same specialization makes monarchs vulnerable. If milkweed disappears from one area, monarchs may have to move to a new habitat. If anything threatens the plant over a larger area, or if the butterfly is forced into habitat where milkweed cannot grow, the caterpillar will not have anything to eat and monarch populations will die.

Adaptations

An adaptation is any trait that helps an animal survive in its habitat.

Monarch butterflies have adapted to the environment in which they live. Diet, behavior, physical anatomy and even physiology (internal mechanisms), are ways animals adapt to their surroundings. Many living things have evolved unique ways of dealing with the problems of survival. An animal's **adaptations** develop over a very long time and can be passed on to offspring, such as an eagle's keen sense of sight or a hummingbird's long beak.

Animals have adapted to even the harshest environments. Some aquatic insects have evolved a way to survive extremely cold temperatures. They can freeze and still live! When the air warms, these insects thaw and return to normal activity–a process that most living things could not accomplish. Desert ecosystems are also challenging. But many plants and animals call the desert home, having adapted over thousands of years to life in a

place that gets fewer than 10 inches of rainfall each year. These adaptations allow organisms like the kangaroo rat, which gets all the water it needs from plants it eats, and the saguaro cactus, which stores enough water to survive years, to live in the desert.

However, adaptations are useful only in the habitat for which an animal is adapted. A freshwater newt, used to living in or near water, wouldn't survive long in the desert.

People often confuse adaptation with adjusting or responding to a change in environment. Adjustment happens, for example, whenever humans climb to high altitudes. On top of a 15,000-foot mountain, it feels colder and there is less oxygen to breathe. Humans adjust through behaviors like wearing warm clothes and staying inside a tent. Within a short time period, humans go through a reversible physiological change, which allows them to breathe in a low-oxygen environment. Once climbers return to sea level, they return to normal. This is a temporary change that is not passed on to children. By contrast, adaptations are inherited from one generation to the next.

Habitat Size

Animals differ in the size of habitat they require. In general, large animals need more food-energy to survive and so need to hunt or forage within a larger habitat than does a small animal. For the larvae of a longhorn beetle, a small area inside a single oak tree may be sufficient. These beetle larvae live below the tree's bark, creating tunnels as they feed on wood and hide from hungry predators. A squirrel might find cover in the same oak, but its habitat, which includes its entire foraging range, stretches over 3 to 4 acres. One kind of warbler bird requires 7,000 acres of forest habitat, while a black bear needs as much as 40,000 acres for its home range.

Many other factors influence habitat size. An organism's feeding habits, mobility, nesting preferences and whether it is territorial all play a role in determining the necessary habitat size. A bee, which has the mobility of flight and needs to find food with a high sugar content, has a much larger habitat than an ant. Plant-eating grazers like buffalo need only a quarter the habitat that carnivores such as wolves require. Leaves and grass are relatively common and easy to find for buffalo. By contrast, prey animals are much harder to find than grass, so their predators need to search a larger area to find them.

Biodiversity and Endangered Species

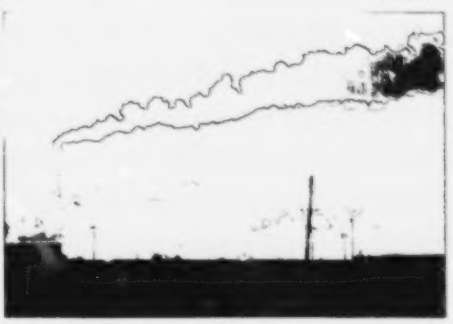
Today, habitat loss is the leading threat facing wilderness, wildlife and North American biodiversity. **Biodiversity** is the enormous variety of living things found in the world today. One

What Causes Habitat Loss?

way to measure biodiversity is to count how many different species can be found within a given area. In a one-acre stand of eastern forest, for example, you may find 30 species of trees. In a tropical rainforest, the same area might yield 200 tree species. Scientists conclude that rainforests have greater biodiversity, not just in trees but in all plants, animals and other forms of life.

Biological diversity has been recognized as an important measure of an ecosystem's health. All members of food webs, including humans, rely on healthy ecosystems to provide food and materials needed to live. The more diverse an ecosystem, the greater chance that some species will be able to survive sudden disturbances in the system caused by climactic change, human impacts or the loss of a key species.

Tropical rainforests face the greatest threats to declines in biodiversity, but much of North America has also suffered serious declines. In 1973, concern over the loss of wildlife led to the federal **Endangered Species Act**, which aims to protect the rarest species from extinction. To date, over 1,000 plants and animals in the United States are rare enough that they have been listed on the federal endangered or threatened species list. An endangered animal or plant has so few individuals left that it has been officially identified as close to extinction. Threatened species are not in such dire situations but have suffered rapid declines in their populations.



The United States Endangered Species Act provides for active conservation and management of these species.

The sheer numbers of endangered, threatened and other vulnerable species has made conserving these species a difficult task. More recently, conservationists and federal managers have shifted focus of their conservation efforts to include entire habitats of endangered and threatened species. Focusing on critical habitats, home to a diverse group of plants and animals, seems the most effective method to save wildlife. In saving the endangered habitat of a rare species, managers will also be able to save the many unique organisms that share that habitat.

Habitat Loss

If humans alter a habitat by building on it, draining its water, plowing through its plant roots or polluting it, we risk losing all the habitat elements that allowed plants and animals to thrive there. If this process continues indefinitely, a plant or animal may lose not only its local habitat, but its place in the world. For example, the dusky seaside sparrow has not been seen since 1987, a disappearance that scientists have noted as another extinction brought on by habitat loss. The sparrow's habitat had been changed and fragmented to such an extent that the birds had no suitable habitat left. In a little over two centuries, much of the North American landscape have been altered by human activities, including development of housing, roads and cities, farming, resource extraction, pollution and overhunting.

Noteworthy examples include:

✔ Prairies once covered 40% of the lower 48 states. Much of this mid-western grassland habitat has been lost to farming, development and overgrazing. In addition, periodic fires that grasses depend upon have long been suppressed, allowing other species to flourish. Wild grazers like bison, which also played an important role in the grass ecosystem, were over- hunted long ago. Scientists estimate that 99% of the tall grass prairies, which once stretched over 90 million acres on the eastern edge of the prairie states, have been lost to development and farming. The results of prairie loss are steep declines in many species numbers, including black-tailed prairie dogs and the very rare black-footed ferrets.

✔ More than 90% of old-growth forests of the Pacific Northwest have been disturbed by development and logging. Many species, such as the endangered Spotted Owl, need a mature forest habitat to survive.

✔ Over 50% of wetlands in the lower 48 states have been cleared, drained, filled or destroyed. Many of those remaining face problems with inadequate water supplies (due to upstream dams and diversions), polluted runoff from agriculture and industry and continued pressure for development. In California, only 10% of original wetlands remain, most lost to agriculture and development. Especially notable has been the shrinking of wetlands in Florida, where the Everglades once reached from above Orlando to the state's southern tip. The loss in wetlands there has contributed to a 90% drop in the number of waterfowl in the area. A full one-third of U.S. endangered plant species grow in wetland habitats.

✔ Although now recovering, more than 80% of New England forests were cut when Europeans settled the region and the land was converted to farmland. As agriculture has moved to the mid-west, eastern forests are slowly re-establishing themselves. Acid rain, a by-product of modern industrial emissions, still poses a threat to the health of these ecosystems.

✔ The southeastern United States was once covered in Longleaf Pine Forests, which stretched from Virginia to Texas. Only about 3% of these historical ecosystems still exist, resulting in endangerment of birds like the red-cockaded woodpecker. The rest has long since been converted to cities, farms and tree plantations or has lost key habitat features due to logging, fire suppression and use of adjacent lands.

✔ Riparian ecosystems face the greatest threats from damist diversion of water and pollution. Most major rivers in North America are dammed to provide energy, control flooding

and divert water for irrigation and other uses. Inadequate river water levels threaten wildlife that need clean, flowing water to drink or deep water for staying cool. In desert regions, where water is generally scarce, river habitats play an especially important role in supporting plants and animals.

Human Impacts

As human populations continue to grow, more and more natural areas are developed or converted to cropland to meet increasing human demands for housing and food.

✔ Development – building houses, streets, highways, offices, schools, shopping centers and parks – is a leading cause of habitat loss. Building on wild land destroys or seriously degrades wildlife habitat.

✔ Converting wild habitat into farmland increases with our need to grow food for greater numbers of people. It also drastically changes the habitat. While some organisms, like migratory cranes on the Platte River that feed on waste corn, can live with farms, others cannot.

✔ Run-off from farms, containing fertilizers and pesticides, can create problems in downstream habitats. If too much fertilizer washes into a lake, for example, the amount of available nitrogen and phosphate can completely alter the physical environment of the lake, creating huge algae blooms, which deplete oxygen and seriously harm or even kill other wildlife living there.

✔ Pesticides also harm birds, butterflies and other insects. Birds of prey, for example, may suffer enormously from pesticides even though they may not consume them directly. Each animal they consume may have a small amount of the toxic substance in its body, and these amounts may accumulate in the bird's body over time.

✔ Human need for natural resources has led to extensive extraction in wild habitats. People use raw materials such as coal, petroleum, lumber and minerals like copper for industry and consumer products. Impacts of this extraction can be extreme and lead to soil erosion and pollution. Places like the Pacific Northwest, with a long history of logging, reveal the impact of resource extraction on wildlife and land.

Humans can have positive impacts too. To save wildlife, we need to better balance human needs with conservation of habitats by taking actions in our daily lives that make a difference. (See "How We Can Help Save Habitats" at the end of this chapter for more information.)

Natural Impacts on Habitats

There are many natural events that have big impacts on wildlife habitat. But even after a

severe flood or fire, most ecosystems can recover. In most cases, the habitat develops back into a healthy community similar to the pre-fire or flood habitat over time.

Other powerful natural impacts can come from disease, extremes in weather and climate change. Disease can destroy a population of one species, which may impact the lives of others. Some 250,000 ducks on Great Salt Lake appeared to have died from botulism, a bacterial disease, in 1932. While the local population of ducks was decimated, ducks from other areas eventually moved in and repopulated the Lake. Even extremes in weather (an especially cold winter or long drought) can become lethal. Hurricane Hugo in 1993 destroyed many older longleaf pine trees that endangered red-cockaded woodpeckers rely on for nesting cover. Healthy populations can recover in time from this kind of event, but recovery is difficult for species already facing habitat threats or low population numbers.

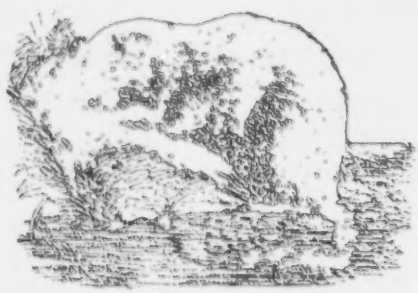
However, some habitats, such as mid-western prairies or longleaf pine forests of the south, actually rely on periodic natural disturbances, such as fire, to stay healthy. Yellowstone National Park is a good example of such an ecosystem and a place where fires have long been suppressed to protect property and people in the area. When large wilderness fires erupted in Yellowstone in 1988, the burning did cause some tragic losses of wildlife and park facilities. But within a few short years, the many benefits of a natural fire (often started by lightning) became apparent. The park experienced an ecological re-birth, with greater plant and tree diversity, leading to greater animal diversity and a healthier, more stable ecosystem.

While most ecosystems have the resiliency to bounce back after a severe natural event, some changes may be too great. **Climate change**, as evidenced in ice ages that regularly occur on Earth, may permanently alter the group of species able to thrive in a habitat. Human activity also may change ecosystems irreversibly. For example, when a new species is introduced to a habitat, the entire structure of the place may change, never to return to its original state.

Introduced Species

Sometimes non-native (called exotic) species are intentionally or non-intentionally introduced into habitats far from their own. Because **exotic species** usually have no natural predators, or because the native species are not adapted to handle their presence, the impacts of these species can be enormous, altering the entire structure of the habitat.

For example, the nutria, a small beaver-like mammal, was imported from South America and released into the wild in a number of regions in the U.S. early in the 1900s. Fur farmers wanted them for their pelts. In Louisiana, 20 animals were released in 1938.



There are now 20 million living in bayous and wetlands of that state. Their voracious appetite for wetland plants, added to their constant digging, has resulted in 100,000 acres of marsh turned into open water, destroying the winter habitat of waterfowl. They have now spread to 15 states. Aside from alligators in the southeast, there are no natural predators to keep nutria in check.

The weedy and shade-loving English ivy plant is another example of a non-native species that has caused many problems for areas they invade. The ivy is native to Europe and Asia and was introduced into landscaping and gardens by some of America's early colonists. It has spread from gardens into many forests, where it creates dense cover on the forest floor and lowers plant diversity in the forest. Little sunlight reaches below ivy and the shade may prevent native wildflowers, trees and shrubs from sprouting and growing. These native plants are the ones wildlife rely on for food, cover and places to raise young. No animals appear to use ivy exclusively to meet their needs, save the European starling, another introduced, non-native species.

Habitat Fragmentation

Habitats may be divided into smaller areas because of development or other land uses, such as roads, housing, parking lots, and lawns, until only unconnected fragments remain. **Habitat fragmentation** can lead to losses of wildlife because it affects habitat size, creates what is called "**edge effects,**" and isolates species from other members of their population.

Some habitat fragments are too small to provide for all a species' needs. A black bear that needs 40,000 acres of habitat to survive, will not survive in a 2,000-acre fragment. Even for species with a smaller habitat need, the fragment may be too small to support enough individuals for a healthy breeding population.

Carving up a large natural area into smaller ones with more edges changes the qualities of a habitat. Many bird species, for instance, live in the interior of a forest and have a hard time thriving along edges, where they are vulnerable to attacks by predators. Physical factors along edges differ too – without the shade of the forest canopy, more sunlight reaches the ground and allows a thick understory to grow. Some birds need a relatively sparse area of forest floor to successfully forage for food.

Fragmentation also isolates populations or individuals by creating barriers to movement. Without forest cover, it may be harder for young to disperse. New individuals from other populations may no longer be able to reach those living in the habitat fragment, meaning that the genetic diversity of the population may decline. Studies show that the smaller the fragment size, the less species diversity.

Restoring Habitats

People can make a difference! Wildlife habitat health can be monitored. Some losses can be minimized or the damage lessened by allowing natural periodic fires, reducing pollution,

How Can We Restore Habitats?

removing non-native species and limiting human use of sensitive areas. Conservation efforts have been successful in setting aside larger tracts of wilderness to remain undeveloped so that wildlife can continue to use the land.

It is even possible to restore degraded habitats. Wetlands can be allowed to refill and people can work to keep water entering the ecosystem clean. In the Everglades, an ambitious habitat restoration project has begun. Federal and state agencies partnering with non-profit organizations and scientists have started to work to bring wildlife back to the damaged ecosystem. The cost of such large-scale restoration, however, is great.

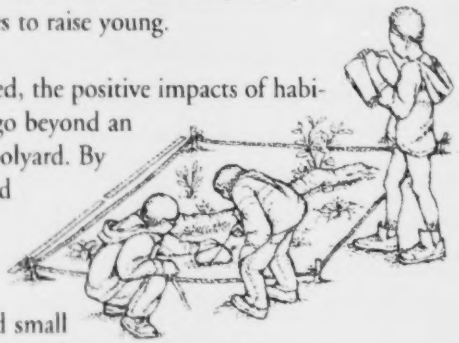
The Everglades restoration will cost billions of dollars. And even with this great effort and commitment, it may be centuries before natural biodiversity and complexity returns to this special place. (*Find out more about the Everglades project at http://www.nwf.org/everglades*).

The Everglades project will take the work of many people to accomplish. But it can be done. And everyone can work to help save or create habitats for wildlife by working in their own backyards, neighborhood parks and schoolyards.

Taking Action for Habitats

National Wildlife Federation's Backyard Wildlife Habitat and Schoolyard Habitats programs help people turn their backyards and schoolyards into valuable wildlife refuges and teaches them the rewards of connecting with nature by inviting wildlife into their lives. These programs tutors everyone —no matter where they live—in small actions that positively impact the environment, encouraging the return of many wildlife species that have disappeared from our communities.

A Schoolyard Habitats site relies on diverse native plants and natural landscaping to provide the four basics for wildlife: food, water, cover and places to raise young.



Once established, the positive impacts of habitat landscapes go beyond an individual schoolyard. By eliminating yard chemical use, establishing storm water buffer areas and small wetlands, choosing plants wisely to eliminate supplemental watering and reducing lawn sizes, a Schoolyard Habitats site contributes to the health of the greater surrounding watershed and ecosystem.

The NWF' Schoolyard Habitats Program's goal is to introduce educators, children, parents and community members to the wonders of nature and provide a hands-on learning opportunity. Hundreds of Schoolyard Habitats sites have been certified by NWF nationwide. In this kit, instructions for creating your own Schoolyard Habitat site are included in the Schoolyard Habitat Guide module of this kit.

For many inspiring tales of school grounds transformation, visit the Schoolyard Habitats website at www.nwf.org/schoolyardhabitats.

The National Wildlife Federation has recognized the work of more than 1,500 schools through a formal Schoolyard Habitats® certification process.

NATIONAL WILDLIFE FEDERATION

43

Glossary

adaptation: inherited physical or behavioral trait that helps a plant or animal survive inn its particular habitat
barrier islands: islands that form where land is nearly flat along the coast, often subject to beach erosion from wind and water
biodiversity: the wide variety of genes, species, and ecosystems that exist on Earth
boreal forest: the broad band of mixed coniferous and deciduous trees that stretches across northern North America, Europe, and Asia.
canopy: the top forest layer formed by leaves and branches of the tallest trees
carnivore: an animal that eats other animals
chaparral: dense scrub vegetation of broadleaf, evergreen, or wintergreen shrubs
climate change: the broad change in temperature and precipitation patterns over time
desert: an arid ecosystem with limited precipitation and vegetation
ecosystem: the set of interactions between living and nonliving components in the environment
edge effects: the set of occurrences, such as increased sunlight and wind, and the appearance of a different set of organisms, in the transition zone from one kind of ecosystem to another
endangered species: a species that is in immediate danger of extinction
Endangered Species Act: the major piece of U.S. legislation that outlines protection for endangered and threatened species
estuary: a partly enclosed body of water where salt and fresh water mix
exotic species: species that are introduced from other areas to places where they are not native
extinction: when all members of a species have disappeared from the earth permanently
food chain: a representation of the feeding relationships between organisms in an ecosystem
food web: a complex set of relationships formed by interconnecting and overlapping food chains
generalist: a species that can find its habitat requirements in a broad range of ecosystems
habitat: a place that contains all the food, water, cover and places to raise young that a living organism needs to survive
habitat fragmentation: when larger areas of habitat are divided into smaller ones by natural or human-caused events
herbivore: an animal that eats plants
keystone species: a pivotal player in an ecosystem, a species that provides essential services upon which other species depend
metamorphosis: the process some organisms go through in maturing from juvenile to adult
native species: a species that occurs naturally in an area
niche: the ecological role played by organisms in their ecosystem
omnivore: an animals that eats both plants and other animals
organism: a living thing
photosynthesis: the process by which plants make food from the sun's energy, carbon dioxide, and water
pollination: the transfer of pollen from the male part of the plant to the female part
population: a group of organisms
predator: an animal that kills and eats other animals to survive
primary consumers: animals in a food chain that eat plants
producers: organisms that make their own food from the sun's energy, e.g., plants
prey: an animal that a predator hunts for food
secondary consumers: animals in a food chain that eat primary consumers
specialist: an organism with very specific habitat requirements
species: a group of organisms that all share the same physical characteristics and can breed to produce viable offspring
swamp: a wetland ecosystem dominated by trees
temperate rain forest: a forest with moderate year-round temperatures and distinct seasons
tertiary consumer: an animal that eats a secondary consumer
tundra: treeless, short vegetation found in regions with long winters and low average annual temperatures
wetland: an area that is regularly flooded, and where the water table stands at or above the land surface for at least part of the year, with vegetation which requires wet soil

NATIONAL
WILDLIFE
FEDERATION®
www.nwf.org™

National Wildlife Federation
11100 Wildlife Center Drive
Reston, VA 20190-5362

(703)438-6100
www.nwf.org

NATIONAL WILDLIFE FEDERATION®
www.nwf.org™

Contents

Habitat Awareness 1

Habitat Basics

Activity 1 – What Is Your Habitat? 2
Activity 2 – Habitat Facts, Habitat Maps 4
Activity 3 – Habitat for Sale 7
Activity 4 – Design a Habitat 9

The Physical Environment

Activity 5 – Climate Around the World 13
Activity 6 – Watching Plants Grow 18
Activity 7 – Digging Dirt 23
Activity 8 – Slopes and Puddles 26
Activity 9 – Wind Power 28

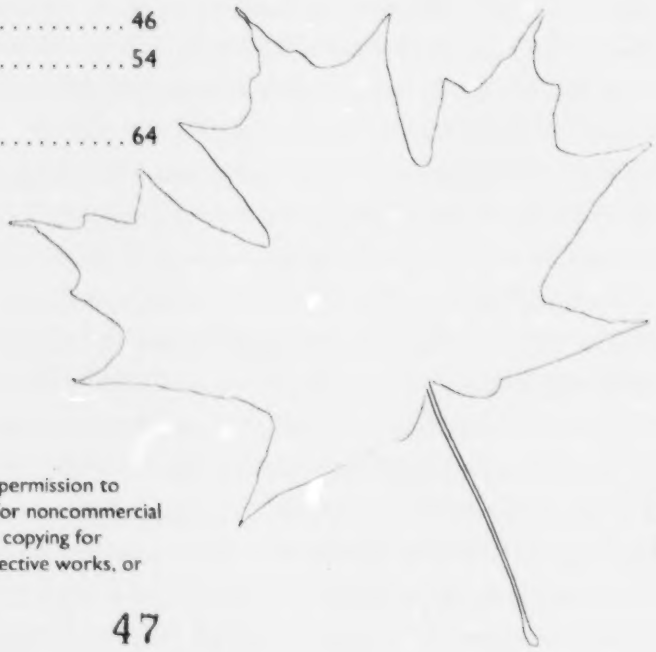
The Living Environment

Activity 10 – Food Chain Mania 32
Activity 11 – Bluebird Madness 37
Activity 12 – Fill the Bill 40
Activity 13 – Schoolyard Biodiversity 43

Habitat Loss & Restoration

Activity 14 – The Pollinators' Journey 46
Activity 15 – What To Do With an Empty Lot 54

Appendix: National Science Education Standards 64

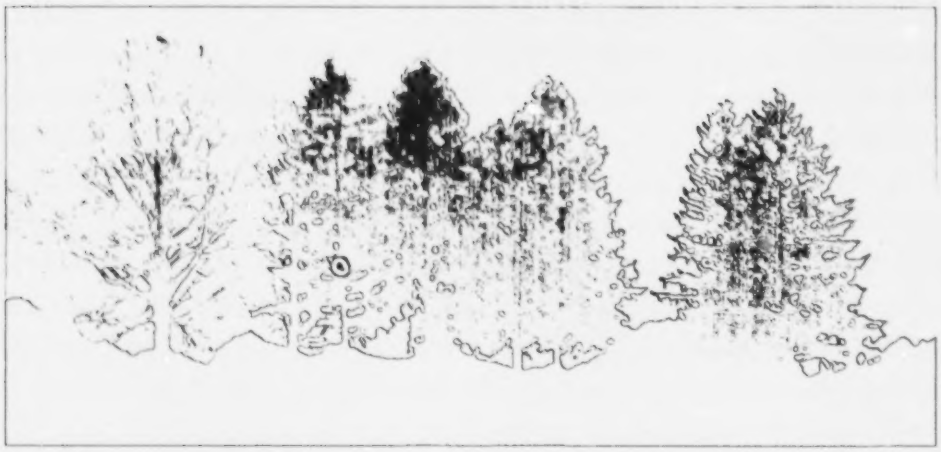


The National Wildlife Federation grants permission to teachers to make copies of worksheets for noncommercial use. This permission does not extend to copying for promotional purposes, creating new collective works, or resale.

Habitat Awareness

In this section, students and educators will explore the concept of wildlife habitat through a variety of activities. Most activities are designed as interdisciplinary investigations. They are meant to build knowledge and awareness on many aspects of habitat. It is our hope that you and your students will use this new knowledge to take action for habitats and make your schoolyard into a habitat and learning site for both people and wildlife. These activities serve as an excellent foundation for the skills need to create your own Schoolyard Habitats® site, the project described in detail in the Schoolyard Habitats planning guide that is a part of this kit.

Each activity includes a background section, subjects covered, appropriate grade level, amount of time activity is likely to take (although this may vary depending on the group and setting), modifications for younger or older students, ideas for extension activities and assessment suggestions. We encourage you to promote inquiry with your students by starting each lesson with questions. Ask students, "*What do you know?*," and "*What do you want to know?*" After completing the activity, ask "*What did you learn?*" as a way to assess comprehension as well as exploring areas for future student-driven explorations of the topic.



ACTIVITY

What's Your Habitat?

Summary

Students explore basic survival needs of humans and wildlife by drawing their own homes and neighborhoods.

Grade Level: K-4; 5-8

Time:
1 class period
(30-45 minutes)

Subjects:
Science, Language Arts, Art

Skills:
Analysis, comparison, application, description, synthesis

Learning Objectives:
Students will be able to

- Name the four basic survival needs of humans
- Recognize that humans share the same basic needs as all other living things
- Create a picture showing how a habitat provides humans with what they need to survive
- Compare human and other animal habitats
- Identify how animals meet basic needs in habitats

Materials:
- Paper
- Crayons/markers
- Pictures of a human house, animal homes, animals in a habitat and examples of different habitats (Start with pictures of forest, desert, grassland and add local habitats students recognize.)

Background

All forms of life, from humans to cows to bears to flowers, need certain things to live. Survival depends on getting enough food, water, cover and places to raise young. Animals, plants, fungi and microbes share these same survival needs, though it is a little more challenging to think about how plants and microbes meet these needs. This activity focuses exclusively on animals. (*Educators may challenge older students to look at the needs of plants and microbes as well.*)

Animals must have a place to live where they can get food, water, cover and places to raise young. Cover may mean protection from sun or other elements as well as protection from other animals (called predators) that may eat the animal. Places to raise young can also mean a protected spot, like a bird's nest, or an area with specific qualities that enable offspring to survive. For example, monarch butterflies lay their eggs on milkweed plants, which provide some cover as well as a food source for growing monarch larvae. Therefore, a monarch habitat must include milkweed plants for the butterfly to raise young.

Do humans have the same requirements as animals? They do. Humans build houses for cover and places to raise young. Other animals may build nests or burrows for protection or cover. Still others take cover where they find it, under trees or in a large herd. But for all animals (including humans), home is much bigger than a house. It's the entire neighborhood where an animal gets the food, water and cover it needs to survive. Scientists call this home or place its habitat. For humans, habitat may mean the neighborhood or city in which they live.

Procedure

1. Ask students, ***What do all humans need to survive? Which of these do plants and animals also require?*** Focus on the four basic survival needs true for all living things. Guide class to generate a list with these needs: food, water, cover and places to raise young. Write the list on the board. Students may give other answers, which you can put with the four major categories.

2. Ask, ***Where do humans get the food, water, cover and places to raise young they need to survive?*** Generate a list of student answers. On the board, you may may want to draw a picture of your own home/neighborhood to show where he/she locates food, water, cover and places to raise young.

3. Pass out art materials to students and ask them to draw their home. They can start with a picture of the house or building where they live. Tell them to leave space around the house to add other parts of their neighborhood where they meet their basic survival needs. Have them each pick a color to represent each of the four basic needs and write it on the bottom of the paper.

4. Ask, ***Where do people get food?*** (Perhaps from a supermarket or garden?) ***Where do they store***

BEST COPY AVAILABLE

and cook food? Have them add these places labeled with "food" (in the food color) to the drawing. Guide students to think about other needs. ***Where does the water they drink and bathe with come from? Is it from a well in the area or is it piped into their home from a reservoir? Where do they go to escape heat and sun or rain and snow? What other habitat elements do they need to survive?*** To think about places to raise young, they should consider themselves the "young" and think about how their parents met this need. Add pictures of these to their drawings of "home." Use the selected colors to label pictures to show what it provides for them (i.e. water).

5. Upon completion, have each student share his or her picture with the class. On the board, note how many of the habitat elements (food, water, cover and places to raise young) students included on drawings. ***Which needs appear on everyone's drawing?*** Tell students that they have just drawn their own habitat. Habitat is home, the place where humans get all that they need to survive. Like all animals, habitat is where humans satisfy the most basic survival requirements - the food, water, cover and places to raise young. (*For those who didn't include the four habitat elements, have them go back and draw the missing ones in.*) Display drawings.

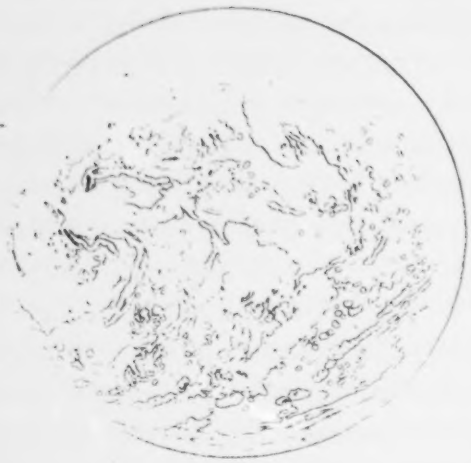
6. As a wrap-up, compare the students' habitats to pictures of animal habitats in the wild. Use pictures of animals that build a home to live in, such as an ant, a bird or a beaver. Then show pictures of animals that do not alter their environment, but find cover all the same – a snake that lives between rocks, for example. Discuss how the habitats are the same or different. Ask students, How might animals find the food, water, cover and places to raise young in the habitat? *This will be explored in the next activity.*

Modifications for Older Students

1. Follow the procedure for younger students, but do not provide as much detail as to the source of their basic habitat elements. Instead, challenge students to identify all the places that help them meet their basic needs within their territory (neighborhood).

2. After students draw their habitat, challenge them to design and draw a Mars colony. (Alternatively, focus on designing a space station or a colony on the moon.) Have them think about the basic needs of living things and how they would meet these on a faraway planet that's very different from Earth. Have them research how the physical environment of Mars (or space or moon) differs from Earth's. They will need to include: a food source, a water source, an oxygen source (air is a critical need for living things, but one taken for granted on Earth), cover from the harsh environment and places to raise young.

3. Once drawings are finished, have students present their ideas to the class and display. Discuss choices that students made.



Ask students if they think that humans depend on the physical environment of Earth to survive?

Extensions

✔ Have the class do a large mural of their combined habitat. Basing the mural on the individual habitat pictures students drew, compile a large drawing as a group, adding in the different features students identified. Perhaps a whole neighborhood habitat will emerge, which can remain on the wall of the classroom and be referred back to in later lessons.

Assessment

✔ Have students keep a journal for a day or a week in which they will write down each time they eat, drink water, sleep in a safe shelter, find cover to escape the heat or cold and where and how they found these things in their habitat. Did they ever leave the habitat they drew during this activity? If so, what were they looking for? Do they think it was a "basic survival need" that should now be added to the drawing? Review their journals for evidence of correct application of habitat ideas to their own lives.

✔ Have students observe an animal at home or on the schoolyard for up to a week. Keep a similar journal to that outlined above for their observations.

ACTIVITY 7

Habitat Facts, Habitat Maps

Summary

Students conduct and present research on a specific animal species, its basic habitat needs and range.

Grade Level: 5-8; K-4

Time:
3 class periods (90 minutes)

Subjects:
Science, Language Arts, Geography, Art, Social Studies

Skills:
Research, application, description, comparison

Learning Objectives:
Students will be able to:
- Define habitat
- Apply concept of habitat to a specific animal species
- Explain how a habitat provides an animal with what the animal needs to survive
- Discover the diversity of habitats
- Work independently on a project

Materials:
- Board or flip chart
- Markers or chalk
- Pencils
- Notebooks
- Butcher paper
- Crayons, markers or colored pencils
- Glue
- Pictures of different animals and plants in their native habitat
- Wildlife resource books and magazines such as *National Wildlife, International Wildlife, Ranger Rick* or *Your Big Backyard*. May include encyclopedias, field guides and general wildlife guides.

Background

Every plant or animal has a place where it normally lives and finds everything that it needs to survive. Scientists call this place the plant or animal's habitat. A habitat provides a plant or animal with all it needs to survive, including food, water, cover and places to raise young.

Most plants and animals cannot live outside of their native habitat. Even though some species can adapt to some environmental differences, most can't usually survive long outside of their native habitat(s). For example, an important part of the golden-cheeked warbler's habitat, its nesting site, is the ashe juniper forests of central Texas hill country. It builds its next out of the bark of this tree, which comes off in long strips. An infrequent neighbor of the warbler, the Brazilian free-tailed bat, needs a relatively dark, dry space like a cave where many bats can hang close together. The juniper would not be a good roost for the bat, nor would a cave supply the needs of the warbler. Other species can and do live in a variety of habitats. Opossum habitat includes broad-leaf forests of North America as well as tropical rain forests, suburban backyards and city alleyways.

Habitats vary a great deal from species to species. A bear's forest habitat is vastly different in both looks and size from a roadrunner's desert habitat. The world's habitats are extremely diverse, as are the living species that call these habitats home. Habitats are a part of one or more ecosystem. (An ecosystem includes both a community of living things and the physical environment in which they live.) Ecosystems are often defined by the dominant kind of plant life in the area; for example, a forest is defined by the presence of trees. In addition, ecosystems may be defined by a characteristic of the physical environment – an estuary, for example, is where a river meets the sea and where there is a mix of fresh and salt water.

Climate (largely defined by prevalent winds, geography, rainfall and temperature) plays a key role in creating the character of an ecosystem. Climate influences whether an animal can live in a certain location or not. The presence or absence of certain plants (as a result of climate differences), which animals ultimately depend on for food and cover, also influences whether an area will provide habitat for an animal.

Preparation

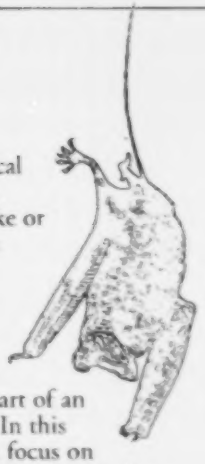
1. Set out books and other resources for research, such as a North American Animal Encyclopedia, books describing the natural history of local wildlife species and local wildlife field guides.

2. Cut 2 feet of easel paper per student. Put aside with other art supplies until research is completed.

Procedure

1. Review the concept of habitat as a place where an animal meets its basic survival needs. Ask, ***What are some places nearby where we might find wild animal or plants?*** (Remind students that insects are animals, too.) Have them describe these areas in or around your town, and list the types of animals and plants they expect to find. Ideas

BEST COPY AVAILABLE



might include local parks, a nearby stream, forest, lake or ocean, someone's backyard or the schoolyard. Tell students that each of these areas probably represent all or part of an animal's habitat. In this activity, they will focus on one animal to discover ways the animal relies on its habitat to survive.

2. Before students get started, give an example of how an animal uses a specific habitat. Preferably, pick an example from the region students live in. Here's one example:

Animal: *Red Bat*

Habitat and Range: The Red Bat has a large habitat range. Red bats can be found throughout the United States, from southern Canada to Mexico. In the U.S., the bat is most common in the Midwestern and mid-Atlantic states. They prefer the dense foliage that often occurs at the edge of forests, and can live in urban areas as well as rural or wilderness areas.

Food: Red Bats eat moths and also some flies, beetles and crickets. They forage for food an hour or two after sunset. (Most other species of bats that live in the same areas as the Red Bat eat one or two hours earlier.)

Water: Red Bats find water in streams, rivers and many other places.

Cover: Red Bats prefer trees or shrubs for cover. During the day, Red Bats hang upside down from a tree branch or in a shrub.

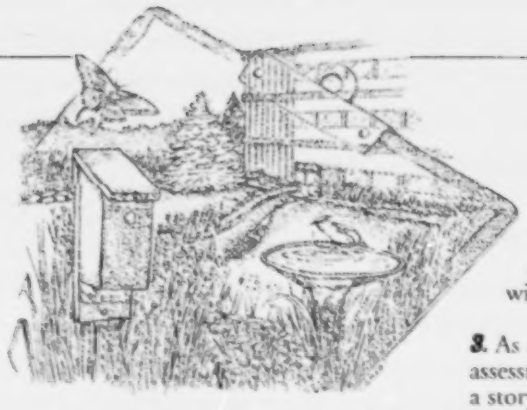
Places to raise young: Bats use the cover of trees and shrubs to raise offspring safe from weather and predators. Newborn bats cling to their mother's fur during the day, but can hang alone when the mother goes out to find food.

Other notes: Usually live alone, covered with dense fur on body (brick red to rusty red), have a long tail, and in winter they may hibernate in a tree while others migrate (they can tolerate body temperatures as low as 23 degrees F!)

3. The next stage involves having each student choose a particular local animal to research. To best prepare for the Schoolyards Habitats project described in the Planning Guide, it would be good to encourage the class to study only species native to or that occur in the local area. Depending on the level of the class, you may wish to have students work as individuals or in small groups.

4. Have students generate a list of questions they would like to answer about their animal. Some examples to get students thinking are given below, but encourage many of their own questions. Ask students to use reference books or the internet to answer as many of their questions as they can. They will probably need to visit a library to gather information. If there are questions they cannot answer through their own research, have students think about how they might go about trying to find the answers.

- ❑ What is the animal's native habitat?
- ❑ What is the animal species' habitat range? (For example, the red bat range includes most of North America and Mexico. The bats are especially common in the Midwest and Eastern states.)
- ❑ Is the habitat largely defined



by geographic features such as high mountains or the presence of water as in an aquatic environment? Do certain types of plants and trees help describe the place, (such as an evergreen forest)? Or can the animal find elements of habitat in a variety of places?

- ❑ What kind of food does the animal eat? Where does it find food in its habitat? Must it hunt over a large area or a small area?

- ❑ What kind of cover does it require? Does it need a burrow to hide from the sun's heat? Does it need a tree nest to sleep in at night? What kinds of cover are found in the animal's habitat?

5. Have students use what they find out to draw an imaginary map of their animal's habitat. Include the places the animal gets water and food, and where it finds cover and places to raise young. Include colors (to suggest hot or cold, wet or dry), plants or animals that might be found there, and features of the landscape (hills, lakes, mountains, rocks) to give others an idea of what the habitat is like.

6. Once each child has finished his/her research and map, have students prepare a short oral presentation (2 to 3 minutes) for the class. Use a map of North America during the presentation so students can point out the species habitat range.

7. After the presentations, compare and contrast different habitats explored by students. Focus on size, locations, appearance and climate. Ask students, ***How are all habitats similar? In what ways do they differ? Which occur in the local region?*** (Ask the latter only if students did not choose local wildlife to study.)

Modifications for Younger Children

1. Simplify the focus of the students' research project with the following checklist:

- ❑ The name of the animal under study.

- ❑ Where does the animal usually live? Where does it make its home? (Ideas include desert, forest, grassland, mountains, ocean, lake, tundra, marsh and chaparral) Show the animal's habitat range on a map of North America.

- ❑ What does it eat? find water?

- ❑ Where does it sleep? Does it build a home? Does it hide from predators?

- ❑ Where does it raise young?

- ❑ Have students imagine being the animal. What would it be like to live in this animal's habitat?

For students in grades K-2, read one or more children's books on individual animals, and ask them the above questions.

2. Have students use crayons or collage to create a picture of the animal in its habitat, with its food, water source, home and place for raising young. Share their maps and what they found out with the class.

3. As an extension or assessment, have them write a story about a day in the life of the animal they chose.

Extensions

✔ Have students find out the current status of the animal they have studied. Are they endangered? Are the populations of the animal stable? Are the number of these wild animals rising or declining? Have they lost habitat to other uses? What are the main threats, if any, to their native habitats? Have people put effort into protecting the animal or its habitat? What has been done?

✔ Observe the schoolyard from the point of view of the animal they studied. Would this make a suitable habitat for that animal? Could it provide all of the basic needs? Why or why not? How can students add something or change the area to make it more suitable? What things would need to be added or changed?*

Assessment

✔ Have students write letters to other students in the class from the point of view of the animal they studied. The letter should include descriptions of the habitat the animal lives in and how it meets its survival needs there.

✔ Activity 3 (Habitat For Sale) provides a good opportunity for assessment if the same animals studied in Activity 2 are used for Activity 3. Make sure students include all four elements of habitat, describe one habitat and connect a habitat with a specific animal.

Habitat for Sale

ACTIVITY 3

Summary:
Students write imaginative classified ads about habitats and then play a game to match specific animals with the animal's native habitat or home.

Grade Level: 3-8, K-2

Time:
1-2 class periods (60 minutes)

Subjects:
Science, Language Arts

Skills:
Analysis, research, comparison, description

Learning Objectives:
Students will be able to:

- Identify the habitat elements used by a specific animal
- Match habitat descriptions with animals
- Describe a specific habitat in a creative way
- Explore the diversity of animals and habitats in the U.S.

Materials:
- Paper and pencils
- Real Estate Ads (from newspaper)
- Encyclopedias, field guides and other reference books on North American wildlife
- Laminated pictures of animals studied in previous activity

Background

Animals and plants are adapted to certain climate conditions. They also depend on one another for survival. Together, climate and other aspects of the non-living (or abiotic) environment and the living (biotic) environment dictate which plants and animals will be able to survive in a certain area.

Plants and animals differ in the kinds of habitats they live in and how they find the habitat elements they need to survive. Studying local wildlife is highly recommended, but this activity may provide an opportunity to delve deeply into one specific ecosystem rather than students randomly choosing an random animal species to study.

Preparation

1. If you did Activity 2, you will have pictures to use for this activity. If not, look in magazines for pictures of animals to be used in this activity. Try ***Ranger Rick, Your Big Backyard, National Geographic, National Wildlife, International Wildlife,*** or other nature magazines.

2. Cut out real estate ads from a local newspaper and copy onto a piece of paper. Make enough copies for all students in class. Also, write out the sample habitat ads included here on the board so students can refer to them during the activity.

Procedure

1. Review the concept of habitat. Habitats are the locations that provide food, water, cover and places to raise young. Ask students to give some examples of different environments where plants and animals might find habitat, such as meadow, forest, grassland, desert, ocean, river or wetland. Discuss idea of the living and non-living parts of a habitat and how animals rely on both (i.e. a tree for cover and a stream for water).

2. Explain that today students will write advertisements for specific habitats (can use same habitat/animal pair as in previous activity). Tell them they will need to think about both living and non-living attributes of a habitat that an animal may use.

3. Have students read aloud samples of real estate classified ads from a newspaper. Tell students that they will write some of their own ads today – ads in which they will describe an animal's habitat or home. Afterwards, students will play a game to match the ads with the correct animals. Use the following as examples (these should also be written on board, or can be duplicated for older students to read themselves):

Home on the Range: Prime Nebraska prairie! Loaded with tasty grasses, this wide-open property boasts refreshing water potholes. Perfect for growing herds that love to roam. Hot in summer, cold in winter. (Answer: Bison)

Underground Castle: Easy-to-dig soil in Smith family's backyard ripe for an ambitious homebuilder. Tunnel away! Home to juicy earthworms, grubs and other tasty creatures. Leaves for bedding

BEST COPY AVAILABLE

there for the taking! No pesky cats or dogs. Available now! (Answer: Mole).

4. If not using same animals as in Activity 2, have students choose animals for this activity. The educator may write names of North American animals on slips of paper (one for each student) and have students choose one. Try to include animals all from one ecosystem, such as those found along Florida's Kissimmee River and in the Everglades. Suggestions include: black bears; deer; ibis; egrets; herons; wood storks; snakes; turtles; ducks; alligators; red wolf; fish; river otters; mosquito; raccoons; dragonfly; frog; beetle; spider; snail; crab; snail kite (a bird); and the Florida panther.

5. If necessary, use reference books (Walker's Encyclopedia of Mammals and field guides are both helpful) to gather information for a short classified ad. Have students write the ads and help them when necessary.

6. Collect ads. Pass out copies of a list of all the animals included in activity with a letter (a,b,c, etc) assigned to each animal. Read the list aloud, showing pictures of the animals while reading the name. Have student volunteers take turns reading the ads, giving each a number (not identifying the author nor the animal at which the ad was aimed). Have students read the ads a second time, this time asking the other students to choose an animal that matches each ad. Have students write down the ad number next to the letter of the animal or animals to which they think the ad applies. (Some ads might fit more than one animal).

7. Go through ads, asking students which animal they think matches and having the child who wrote it tell the correct answer. Discuss the ones that students missed.

Modifications for Younger Children

You can create the ads, read them to the students, and have them guess. Create a colorful bulletin board display and place animals in their correct habitat.

Extensions

✔ Ask students to list any additional questions about animal habitats. Challenge each student to find an answer to at least one question for the next class meeting.

✔ Repeat the activity, but focus on plants and their habitat needs.

✔ The habitats of individual animals and plants overlap with many other habitats. In small groups, create a brochure for an ecosystem such as a forest, desert, grassland, lake or ocean that will appeal to a number of the plants and animals. Describe the average amount of rainfall, sunlight and temperatures. What kinds of food, water, cover and spaces are available? What does the ecosystem look like? In the process, discuss how animals share habitats. Does meeting their basic needs put them in conflict such as in a predator and prey relationship? What is their relationship – are they competitors, cooperators or do they ignore each other (a neutral relationship)? Could they divide their resources to avoid competing?

Assessment

✔ Ask students to develop a plan for a butterfly garden habitat or an earthworm soil habitat that they could build at the school. What living and non-living things would need to be included to meet the needs of butterflies or earthworms? This is a good lead-in to the School yard Habitats project.

✔ If students do the first two activities (*What's Your Habitat* and *Habitat Facts, Habitat Maps*) and focus on the same local species, this activity can serve as an assessment to the earlier activities. Assess each classified ad to determine if it does accurately describe the habitat requirements for the species each student chose.

Design a Habitat

ACTIVITY 4

Summary

Students create an artificial habitat for an animal they have chosen.

Grade Level: 3-8

Time: 1-2 class periods

Subjects: Ecology, Art

Skills: Analysis, application, construction, description, evaluation, problem-solving, research

Learning Objectives:
Students will be able to

- Apply understanding of habitat elements to animal survival needs
- Design an imaginary habitat that meets the needs of a particular animal

Materials:
- Crayons, markers, and/or colored pencils
- Scissors
- Scratch paper
- Drawing paper
- Construction paper
- Cardboard or poster board
- Glue
- Other art materials as available, such as felt, pipe cleaners, dried leaves or grass, patterned cloth, twigs, etc.
- Reference material: animal field guides, encyclopedias, wildlife magazines
- Exhibit Design Worksheets #1 and #2, pp 11-12

Background

Some people actually create habitats for a living. Who? Zoo exhibit designers! Each habitat at a zoo is designed, built and maintained by zoo workers to meet the needs of the animals on display. You may want to take your students to visit your local zoo to observe some of these elaborate artificial habitats. Spend time at a few zoo exhibits to see all the things the zoo must do to provide each animal with what it needs to survive. This may include providing special plants in the habitat, a complex diet (usually hand-prepared by zoo workers), air conditioning, shade, hiding places, water to drink, water in which to swim or cool down, and things to climb. Some animals, like penguins or polar bears, have artificial habitats that require a lot of work and energy to maintain.

In this activity, students will think about the habitat needs of an animal they choose and then design a zoo exhibit to meet these needs. These activity and its presentation can be used as an assessment of students' understanding of habitat concepts gained from previous activities.

Procedure

1. Ask students, *What are the basic elements of a habitat? What do animals need in their habitats?* Encourage students to come up with food, water, shelter, and places to raise young. If you have done any of the previous activities, review the different ways animals meet these needs, i.e., what they eat, where they find water, what kinds of shelters different animals use or create, and the different places they use to raise their young.

2. Ask students, *Can you think of a place where people create many different habitats for animals?* Encourage students to think of parks, zoos, and aquariums. Tell students to think of their local zoo, or their favorite exhibit there. *How do people meet the habitat needs of animals in these places?* Make a list on the board. Some examples may include: artificial trees, indoor climate control (heating or air conditioning), bringing special food, perches for birds, special lighting (for nocturnal animals), burrows, pools or ponds, feeding stations, rocks, caves, large open areas, vines to swing on, and so on.

3. Hand out Exhibit Design Worksheet #1. Tell students to look at each of the four pictures and identify the sources of food, water, shelter and places to raise young in each one. Take note of the size and shape of each exhibit and what kind of food is available. Note that A, C, and D are aerial views, while B is a front view, as from a window. Students should identify which exhibit would make the best home for the four animals listed at the bottom of the worksheet. After they are done, go over the worksheet together, identifying habitat elements together. (Answers: A=gorilla, B=parrot, C=sea lion, D=python)

4. Now students will create their own zoo exhibit. You may want to have students work individually or in pairs. Each one should choose a local, native animal to exhibit. Have students

BEST COPY AVAILABLE

write the name of their animal at the top of Exhibit Design Worksheet#2. Then, students should take some time to imagine their artificial habitat. Encourage them to ask themselves, *What is the native habitat of this animal? How does it meet its needs for food, water, shelter, and places to raise young in the wild?* It may be necessary to take some time to do research with encyclopedias, field guides, wildlife magazines, or other reference materials to answer these questions. *How can we meet the animal's needs in a zoo or aquarium?* Students should sketch their designs in the space provided, thinking about these needs. Encourage students to think about these questions:

- ❑ How much space does my animal need?
- ❑ What kind of place does it live in, i.e., a lake, ocean, forest, desert, wetland, tundra, prairie?
- ❑ How does the animal move around? Do I need to provide trees, rocks, ledges, etc?
- ❑ What does the animal eat? What diet do I need to provide it with?
- ❑ How does the animal get water? How can I provide water in the exhibit?
- ❑ What kind of cover does it need? Trees, borrows, rocky ledges?
- ❑ What does the animal need to raise its young?
- ❑ How can we provide the animal with all of its needs and also make sure that people who come to the zoo will be able to see it clearly?

5. Once students have finished their sketches, you should go over each one to make sure basic habitat needs are being met. Then, encourage students to use construction paper, cardboard boxes, and other craft materials to build a two or three-dimensional model of their exhibit, depending on time and materials available.

6. When your students have completed their models, have them take turns presenting their models to the whole group. Included in their presentations, students should give a basic description of their animal's natural habitat, and how they have met the animal's needs in an artificial environment.

Extensions

✔ Have students create the graphics that would accompany their exhibit at the zoo, providing information to the visiting public. Students should pay attention to which information they want to present, and how to present it so it is clear, exciting, and fun to look at.

✔ Have students work in larger groups and create multi-species exhibits. Students should first research what animals live together in their natural habitat, and how a zoo might be able to provide for all of their needs in the same space.

✔ Have students research the history of zoos and do a report on how zoos have changed over the last one hundred years. How are zoos a type of wildlife management?

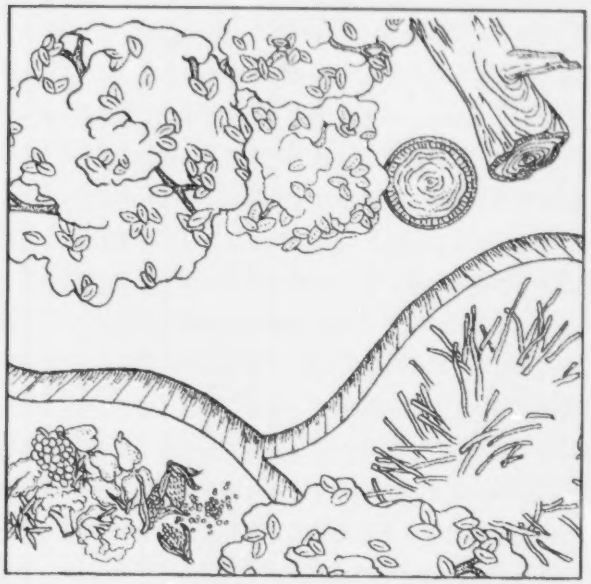
✔ Have students learn about other students who have successfully created wildlife habitat outside on their schoolgrounds by visiting a nearby school with an NWF-certified Schoolyard Habitats Site. Visit www.nwf.org/schoolyardhabitats to find out the location of your closest site.

Assessment

✔ Take students to a zoo or aquarium and have them identify how the habitat needs of several selected animals are met through their zoo exhibits.

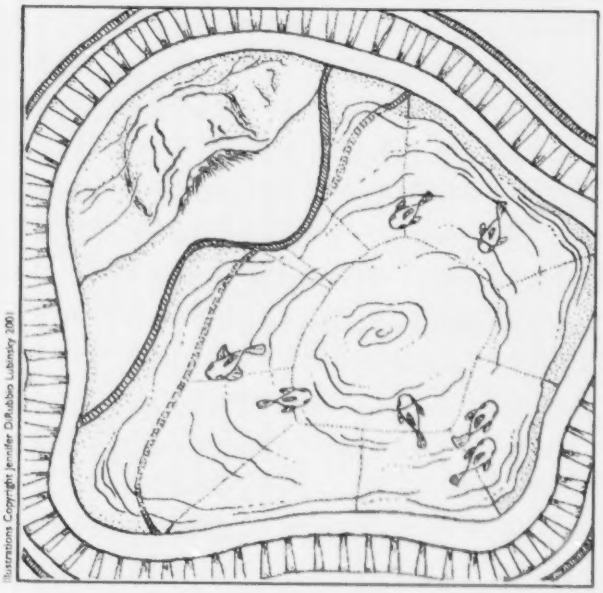
✔ Before students give their presentations, have them walk around the room and assess each of their peer's exhibits, identifying each animal and making a list of how that animal's habitat requirements are met by the exhibit model created.

Exhibit Design Worksheet #1

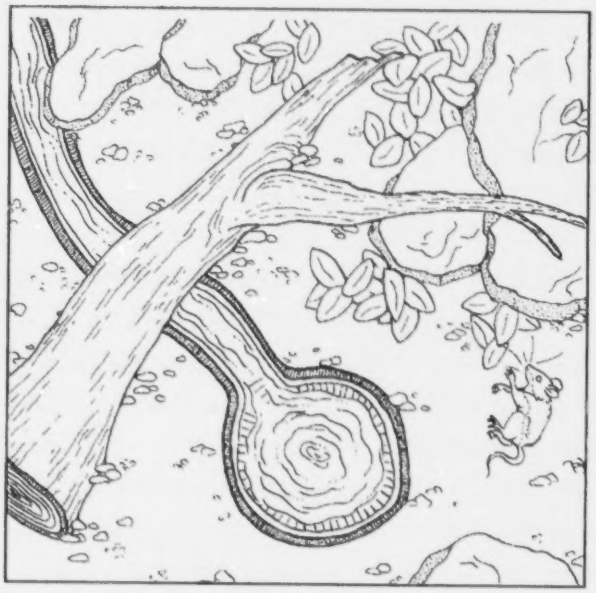


A

B



C



D

Illustrations Copyright Jennifer D. Rubin Lubinsky 2001

Python _____ Sea Lion _____ Gorilla _____ Parrot _____

© Copyright 2001 National Wildlife Federation

ACTIVITY 4 WORKSHEET

Exhibit Design Worksheet # 2

My animal _____

How I provided:

Food _____ Cover _____

Water _____ Place for young _____

© Copyright 2001 National Wildlife Federation

Climate Around the World

ACTIVITY 5

Summary

Students research and map global climate patterns and habitat distribution before collecting data on rainfall and temperature in their own community.

Grade Levels: 3-8

Time: 60 minutes (1 to 2 class periods) and follow up over 1 month

Subjects: Geography, Science, Math

Skills: Observation, research, synthesis

Learning Objectives:
Students will be able to:

- Define climate and how climate differs from weather
- Relate climate to ecosystem and habitat
- Classify regions of the world in terms of ecosystems (desert, forest, tundra, grassland, aquatic)
- Measure local rainfall and temperature
- Chart rainfall and temperature data over 1 month and compare to published accounts
- Determine climate of local area

Materials:

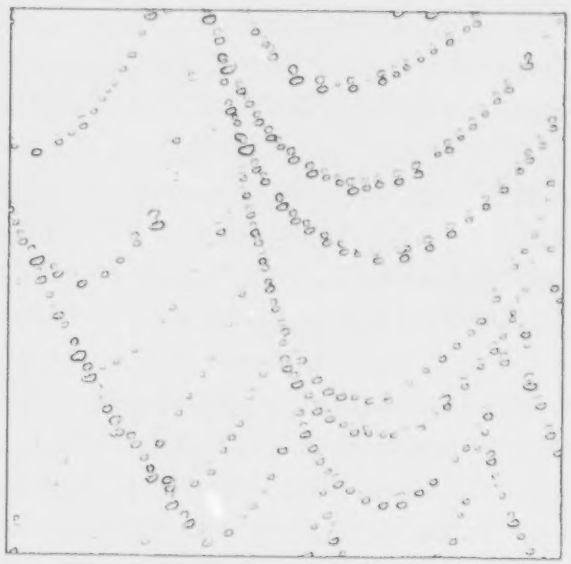
- References including a world atlas, books about global climate patterns, simple maps of biome distribution (See, for example, *Reader's Digest's How Weather Works* by Michael Allaby, 1995.)
- Journals
- Pencils
- Copies of World Map (see page 15)
- Crayons, Markers or Colored Pencils (provide 9 different colors)
- Local newspaper (daily)
- Graph Paper
- Outdoor thermometer (preferably, non-mercury)
- Materials for Rain Gauge:
  - Rulers
  - Scissors
  - Empty 2L bottle (must be clear plastic)
  - Colored (or electric) tape
  - Medium-sized rock

Background

Weather refers to the atmospheric conditions (including air temperature, wind, moisture in the air and air pressure) at a particular place and time. In contrast, climate is a long-term pattern of weather that often repeats itself each year. For example, the climate in a desert is dry all year, hot in the summer and cold in the winter. People classify climates by the average annual amount of precipitation and average seasonal temperatures. Together, these two factors largely determine a region's climate.

Precipitation includes rainfall and all other forms of water (drizzle) or ice (sleet, hail, snow) that falls to the ground. In the United States, some areas receive more precipitation than others. The eastern U.S., for example, receives 65% of the precipitation that falls in the nation, while the western states receive only 35%.

Precipitation and temperature levels are influenced by a number of factors, the most important of which are: the prevailing winds in the area, closeness and location relative to mountains, elevation (how high above sea level a place is; latitude (how far a place is above or below the Equator, which has a latitude of zero) and the presence of a large body of water (coastal regions have milder weather than inland regions). Temperature and its variations from place to place work to create global patterns of winds and precipitation.



BEST COPY AVAILABLE

The amount of sun that reaches the Earth also determines the temperature of a region. As air is warmed by the energy of the sun, its temperature rises. Some places on the globe receive more direct sunlight and so are warmer than other places. The Earth is tilted on its axis, so the sun strikes different areas of the planet at different angles. Since the sun reaching the equatorial regions is concentrated in a relatively small area, the region tends to be much warmer than other latitudes. Sunlight that hits the polar regions is spread out over a larger area, and so the areas are colder than mid-latitude regions. The amount of sunlight reaching an area changes with the seasons and from hour to hour, thus the differences in temperature during winter and summer or from afternoon to night.

Climate determines the distribution of land ecosystems on the globe as well as the types of habitat found in a region. Many of these ecosystems are defined by the dominant type of vegetation found there, something closely tied to temperature and moisture. Notably, different areas around the world share the same type of climate (such as deserts in Australia, Africa and North America) and similar types of habitats exist within these large ecosystems. Deserts, forests, taiga, tundra, grasslands as well as aquatic environments such as wetlands, lakes, rivers, oceans are all vast ecosystems found all around the world. Studying climate will help students understand why certain kinds of vegetation grows where it does.

Preparation

1. Copy map from page 15.

2. Provide reference books or have older students do research to find their own.

3. Make sure the class will have access (in newspaper or on the Internet) to local rainfall and temperature data for one month

Procedure

1. Introduce the meaning of climate. Ask, ***Do any students know what the climate of the local area is?*** Does anyone know how scientists figure out what a region's climate is? What are some physical factors that influence the climate of a region? Introduce idea that climate largely determines the global distribution of ecosystems, such as deserts, forests, grasslands, etc. Why? Have students think about why temperature conditions should determine what food, water, shelter and space is available as wildlife habitat. Give students time to answer these questions in small groups.

2. On a large map of the world, point to areas such as the Sahara Desert, the Tropical Forests of the Amazon region and the American Midwestern Prairies. Ask students what they think the weather is like in each place. How did they know (or guess)? The name of the type of ecosystem (and habitats within that ecosystem) gives them a clue to the type of climate found in these places – deserts are called deserts because they receive little rain and daytime temperatures may be very hot during the summer; tropical forests are warm and wet; and, although many students may not know this, grasslands like the prairies of America or the savannas of Africa receive a relatively small amount of rain and are hot and humid in summer and cold and snowy in winter. (Be sure to discuss the difference between weather [short-term] and climate [long-term and usually repeating] with students.)

3. Students will now do a mapping activity in which they will identify the major climate types on Earth. Have children look in age-appropriate reference books showing relationships between ecosystem type and climate (rainfall/temperature patterns). These are available in most atlases, children's science books about habitats and biology, ecology or geography texts. Pass out maps of the world (next page) and crayons (or colored pencils or markers). For younger students, you may want to enlarge this worksheet. Have students create a color-coded legend on the bottom of the map that shows the relationship between rainfall/temperature and the type of ecosystem found in a region. (Each type of ecosystem can be one color.) Then have them locate these regions and color them the correct color. For younger students, go through these together as a class, with students coloring in the maps along with class discussion.

Have students consider these questions, depending on age-level and ability: ***Is annual precipitation (rain, snow, sleet, etc.) or temperature the most important factor in determining climate? (They are equally important.) How can similar ecosystems be found in places as far away from each other as***

© Copyright 2001 National Wildlife Federation

Australia, Africa and America? (They share the same climate.)

Do you think an animal or plant species adapted to live in the Sahara Desert might be similar to an organism found in the Sonoran Desert of Arizona and Mexico? (Yes, since the species live in a similar environment, some may have evolved similar strategies for dealing with things like a lack of water and harsh sun in a process called convergent evolution.) ***Is the climate the same for every town in a broad region, such as the Midwest, or will it differ across the region?*** (Introduce idea of a micro-climate, which takes local features, such as mountains, valleys, amount of shade or sun, into account and so is more specific to one place than a regional climate.)

Ask students if they have any remaining questions about worldwide climate patterns.

4. Show students the weather section of a local newspaper (or look on the Internet for local information). Review how to find the local precipitation and temperature data. For the next month, students will record this data in their journals to compare with their own findings about the schoolyard habitat. They will also need to record the date and daily precipitation and temperature data they measure in their journals.

5. Pass out materials for students to make their own rain gauges.

❑ Have students cut the 2-L bottle about 3/4 from the bottom, so the width of the bottle is the same as the base width, creating a straight-sided container. (For younger children, educators should do the first step before class.) Use electric tape to cover the sharp edges of the base and the top. Set the top aside for now.

❑ Students will now make a scale that will allow them to measure the amount of rain they collect. Mark zero near the bottom, where the sides of the bottle are still straight. Use a ruler and mark the scale, going from zero up by half inches (or other units). Use colored tape to show the scale.

❑ Place a rock or other weight in the bottom of the bottle so it will not fall down in a storm. The rock needs to be below the zero mark on the bottle.

❑ Add water to bottle until the

63

water line reaches the zero mark. Turn the top piece of the bottle upside-down and place inside the lower half of the gauge. The top pieces will help funnel water into the gauge. Remember to check for evaporation of the zero level and replace water as needed.

Have students place their gauges outside. Let them pick the locations. Each school day, have students measure how much rain they collected in inches or centimeters, depending on scale used on bottle. Students should record what they find in their journals and on the class chart (taking an average of the whole class' measurements).

6. Create a chart on the board with columns for: date, time, air temperature measured, temperature from the newspaper, precipitation measurement. Each school day, pick a volunteer to go outside and measure the air temperature. He or she will write it on the board for everyone to record. Make sure students measure the air temperature at around the same time each day (preferably in the morning). The newspaper records only the high and low temperature, so have students average the high and low from the newspaper before entering into the chart. (An older class can report this information for younger students.)

7. After one month, have students review their class chart (Have older students determine the averages of their measurements as well as the averages of the newspaper data. Let them choose whether they want to do this as a weekly average or a monthly average.)

8. Pass out graph paper. Have students create two graphs. One should compare precipitation measurements they took with those from the newspaper and the second will compare temperature data. Have them use one color for their data and another color for the newspaper data. When they are finished, discuss differences between class findings. ***Did some students measure more precipitation than others? What's one explanation of why that might happen?***

Discuss any notable differences between the class findings and the newspaper findings. ***Why do students think these numbers might be different?*** Discuss possible explanations. One is the different ways that the two types of data were collected (i.e. the temperature data from the newspaper is the average of the day's high and how, while the class temperature data were taken at a single time of the day). Another factor is that regional precipitation and temperature data may not match measurements taken at a single location, due to microclimates, or the type of instruments students are using. Encourage students to present their own ideas.

9. Ask students, ***What do the precipitation and temperature data tell students about the type of ecosystem and habitats found in the area? Is their Schoolyard Habitat representative of the region's temperature and rainfall? Why or why not?*** Have them write an explanation of their answer.

Extensions

✔ Measure and record temperature and precipitation data once a week for 3 months and determine the averages. Does this give a different picture of what the local climate is like? What does it show about seasonal weather?

✔ Using a newspaper or internet weather page, have students record the highest and lowest temperatures in different parts of the world each day. What does this tell you about the climate of these places? After recording these temperatures for a couple of weeks, play a game to have students guess where the highest or lowest temperature will be on the next day.

✔ Record temperature/precipitation data in different locations on school grounds. Compare findings.

✔ Visit a local weather station or meteorologist to discuss regional weather and climate.

✔ Research native plant or animal adaptations to the regional climate.

Assessment

✔ Have students identify and compare a "Sister City" or a "Sister Region" with a climate (and habitat types) similar to their own city or region. Create a weather data chart/graph for this sister place from newspaper data. For younger students, create a collage of pictures from the two sister cities to show similarities and differences along with weather data.

ACTIVITY [redacted]

Watching Plants Grow

Summary

Students do experiments with live plants to explore how moisture, light and temperature affect the growth of plants.

Grade Levels: 3-8

Time: 1 class period for set up (20-40 minutes), plus follow-up over the next weeks (5-20 minutes on maintenance and observations on Days 2-21)

Subjects: Science

Skills: Analysis, comparison, description, generalization, research

Learning Objectives:
Students will be able to:

- List three components of the physical environment
- Name the four habitat needs of plants
- Compare plants grown in moist conditions to those grown in dry conditions
- Compare plants grown with sunlight to those grown without
- Explain how higher and lower temperatures affect plant growth
- Describe how plants, like all living things, meet their needs more easily in certain environments than others

Materials:
- Science Journals
- Pencils
- Six small (2-3 inch), fast-growing plants (peas or beans are good) of the same species
- Six small plant containers with drainage holes
- Potting soil
- Ice (needs to be supplied each day)
- Three measuring cups
- Three thermometers (We recommend using non-mercury thermometers)
- Plant Growth Data Sheet, p. 22

Background

Plants, like all living things, need food, water, cover and a place to raise young to survive. While their survival needs are similar to animals, the way they go about meeting these needs in their habitats are very different from animal ways. Plants thrive in a wide variety of conditions, but each plant species does best in a certain kind of physical environment, where conditions such as sunlight, moisture, temperature, wind and other factors combine to form a suitable habitat. (See the Background Section for a complete list of physical factors.)

Plants make their own food through the process of photosynthesis, which requires water as well as carbon dioxide gas and energy from sunlight. To make food, green plants depend on sunlight. Some plants, such as those that live on the forest floor, are adapted to live with less sunlight than the large trees that make up the forest, but all green plants require energy from the sun to make food. Plants native to more northern locations, where sunlight is less intense, can survive on lower levels of light. Other plants, adapted to the steady supply of sunlight found in Equatorial regions, may not be able to survive in a northern location due to the lack of sunlight. Sunlight is just one example of a factor of the physical environment that helps define a plant's habitat.

Water (moisture) represents another crucial survival need for plants. Plants stay in one place for their entire lives, and so cannot move around in search of a water source or a better location. Instead, plant roots grow toward water in the soil and depend mostly on rainwater or underground water supplies to meet water needs. For potted plants, a well-watered soil will feel moist to the touch one to two inches below the surface. Note that overwatering a plant can be just as damaging as not watering at all. The extra water encourages diseases of the roots and floods air passages in the soil. Other key needs include carbon dioxide gas; some oxygen gas; a tolerable temperature (extreme lows and highs may damage a plant, or even prove fatal) and the presence of minerals such as nitrogen and phosphorous in the soil, which are limiting factors for growth.

BEST COPY AVAILABLE

Plants, like all living things are affected by limiting factors, which may be part of the physical environment or the living community of plants and animals. For example, in a dense forest, a young seedling may be limited in growth by the lack of sufficient sunlight. Any element in short supply (or with an excess supply of, such as plants that are over watered) may limit the growth and development of an organism, resulting in slow growth or even death. The following activity tests limiting factors on the growth of a plant species.

Preparation

1. Select and prepare plants for the class. Alternatively, have students plant seeds to grow their own plants several weeks in advance of the time you plan to conduct this lesson. Find out about the proper care of the chosen plant, its species name and the plant's native habitat. Use native plants if possible, because you may be able to transplant your seedlings to the schoolyard after the activity is completed.

2. Identify areas to do experiments. For example, for the sunlight group, locate the part of the classroom or schoolyard that receives a lot of sunlight (perhaps on the window sill) and a spot that receives no light. Alternatively, have students identify the variables they want to measure and the locations to use for each.

Procedure

1. Remind students that all organisms have evolved to live in certain environments. Ask students how they think physical factors such as temperature, elevation, sunlight and water availability all influence the type of environment where a plant or animal can live. Some physical factors are also limiting factors, a habitat element that slows or stops growth when in short supply or in excess. Tell students that today they will focus on discovering limiting factors (and thus identifying critical survival needs) of one species of plant. Students will work in 3 groups. Groups will focus on 1) sunlight, 2) temperature or 3) moisture to discover how these physical factors affect plant growth.

2. Ask students to talk within their groups about what they want to know about how different factors influence plant growth. They will most likely come up with light and water, among others. Explain that they are going to do an experiment to test several of these factors – light, water, and temperature. In their groups, have students write down a group prediction, or hypothesis, about which plant will grow best.

3. Provide 2 small plants to each group. Students should label the plants either with numbers (No. 1 and No. 2) or with words (No Water, Water). The water group will control the amount of water by their action. However, the sunlight and temperature groups will either use the areas of the classroom already identified by the educator as full-sun and no sun or room temperature and cool temperature. (Educators

may want to challenge older students to figure out how to best test the plants.) Have students use the sense of touch to detect moisture and vision to keep track of the amount of sunlight. Students testing temperature will need to use a precise thermometer to measure the temperature of the soil.

- ❑ For the water experiment group: Place plants side by side in the same sunlight and room temperature conditions. One plant will be watered and one plant will not be watered. For the watered plant, use about 1/4 cup of water (or less) twice a week. Give no water to the other plant.

- ❑ For the temperature experiment group: Place plants in the same light conditions and water them with about 1/4 cup of water twice a week (use the same amount of water for each plant). Place one plant in an ice bath (place plant in a bowl and place this in a larger bowl filled with water and ice cubes) Students will need to add fresh ice each day to keep the temperature cool. Put the second plant at room temperature. Students will use a thermometer to take the temperatures of the two plants' soil.

- ❑ For the light experiment group: Place one plant in full sun. Partial sun is fine too, if that's what is available indoors. The more contrast between the plants, the more impact the activity will have on students. Put the second plant in a cardboard box near the first plant. Make sure the box blocks all or most of the sunlight. Water the plants the same amount. Test the soil temperature of each plant to make sure they are similar. If not, move box or sunlit plant to keep temperatures similar.

4. Every other day, group members should observe the plants closely and make notes of any changes or differences between the plants. They should also measure the growth of the plant stems, count any new leaves and f...l the wetness of the soil (1-2 inches below soil surface). Make observations on the amount of sunlight reaching the plants at the time of observation, take soil temperatures and record air temperatures (look in newspapers for these). Record all findings in journal.

5. Continue maintenance and observations for 21 days. At the end of each week, discuss results and ask students what they think will happen over the next 7 days (in the last week, this will be an "If we were to continue this experiment" question).

6. On Day 21, have groups summarize their results. Which plant grew the most? Which grew the least? Were they all the same in terms of how they looked? Discuss conclusions from the study. To help them think about cause and effect, use these questions:

- ❑ How does temperature affect plant growth? (See if the plant put into colder conditions on a regular basis grew more slowly, more quickly or at the same rate as the plant kept at room temperature.)

- ❑ How does light affect plant growth? (Compare the plant growing in full sun with the plant kept in the shade of the box.)

- ❑ How does moisture affect plant growth? (Compare the growth of the plant that received water with the unwatered plant.)

Extensions

✔ Grow one type of native plant in pots using the same soil type on different areas of the school grounds to look for how the physical environment of the outdoors affects growth. Measure plant growth and describe the sunlight conditions (vs. shade), measure the soil temperature,

and use fingers to feel the moistness of the soil of plants at different spots. Compare the plants grown at different locations and determine which, if any, grew the most. Have students report on the different habitat conditions that exist in different areas of their schoolyard. This information can be used in selecting appropriate plants for their habitat project.

✔ Draw or paint pictures of the plants after the experiment to explain what happened to each one.

✔ *What is the effect of adding nutrients to the plant soil?* Add plant nutrients such as fish emulsion and compare its growth over time to a plant that did not receive nutrients. (Keep all other conditions of light, temperature and moisture the same for the two plants.) Explain to students that adding nutrients is the function of the fertilizers many farmers and gardeners use.

✔ Seeds sprout (or germinate) under different conditions. Some are designed to sprout after a cold period (such as winter), some after a hot period (such as summer) and some use other cues to begin germination. Do an experiment to figure out the preference of radish or dandelion seeds by baking some seeds (in the oven at 200 degrees for 20 minutes), putting some seeds in the freezer (for 20 minutes) and leaving some at room temperature. Then plant the seeds and see which grow the fastest and best!

Assessment

✔ Have students write down 1 or 2 questions they have about plant growth. Then have them design their own experiment to answer this question. Whether they have time to actually do the experiment is not as important as looking at the design of the experiment, and if it makes sense for testing their question.

✔ Create a graph showing plant growth on one axis and days passed on the other. Use three different colors to compare the growth of the six plants.

ACTIVITY

WORKSHEET

PLANT GROWTH DATA SHEET

I am in the group (circle one) testing the effects of: **Light** **Water** **Temperature** on plant growth.

Prediction for experiment:

Instructions: Every other day observe your plants, measure their stems, count new leaves, measure soil and air temperature, and make note of any other changes you observe on the back of this sheet.

Conditions *(fill in:)*

Day	Stem	# Leaves	Soil Temp	Air Temp	Stem	# Leaves	Soil Temp	Air Temp

© Copyright 2001 National Wildlife Federation

Digging Dirt

ACTIVITY

Summary

Students use a variety of techniques to define the characteristics of the soil in the schoolyard.

Grade Levels: 3-8, K-2

Time: 30-45 minutes
(1 class period)

Subjects: Science, Language Arts

Skills: Classification, comparison, description, generalization, observation, research

Learning Objectives:
Students will be able to:

- Define soil and identify the two main ingredients of soil, humus and rock particles
- Compare different types of soil
- Identify soil as a habitat that supports many forms of life
- Explain how soil characteristics affect the species that can live there

Materials:

- 3 samples of different soils (1 quart to 1 gallon of each soil depending on class size and whether activities are done individually, in groups or as a class)
- Ziploc bags
- Water
- Measuring cups
- Journals
- Pencils
- Clear jars with lids (1 per group)
- Small trowel or large metal spoon
- 3 plastic cups per group
- Plastic pipettes or turkey baster (1 per group)
- Distilled water
- Red litmus paper
- Blue litmus paper

Background

Earth's land surfaces are covered with a thin layer of soil – a mix of small pieces of rock and organic material. Organic material is called humus and is made up of the mineral-rich remains of dead animals and plants. Humus also retains water so that it remains accessible for plants.

Soil provides the water and minerals plants need to grow. Soil is essential to life on Earth since all animals depend on plants for food directly or indirectly. It takes thousands of years to form a mature soil, which forms layers. On the surface is topsoil, which is dark and filled with humus and is the layer plants in which plants grow. Below that layer is the subsoil, which is lighter in color, made up mostly of clay and contains less humus. A layer of partly broken-down rock lies underneath the subsoil. A layer of intact bedrock forms the bottom layer.

Water and air in the soil is essential for plants but also for numerous small animals that live in the soil. Air allows the decay of dead plants and animals, which provides minerals and other nutrients to others in the soil habitat, particularly plants. Plants also require a small amount of oxygen to survive.

Fertile soils, where plants grow well, contain minerals and water. Minerals can be depleted from soil, especially on crop lands used for years and years to grow a single crop. These poor soils can be improved by adding fertilizers or humus to the soil to replace minerals taken up by plants.

Soils can be characterized by texture, color, ingredients, the amount of air pores in the soil, chemistry (acidic or alkaline) and other factors. Plants absorb water and air from the soil, as well as important minerals that help them grow. For plants then, the texture of the soil is key in determining whether water and air will be available for roots to absorb. While some soils let water flow through them, like a sieve, other soils hold water in the topsoil, keeping it available for plant roots. (Generally the more humus or clay in the soil, the better it holds onto water.) Wet, acid soil harbors fewer critters than alkaline soil, which holds more minerals that support both plant and animal life in the soil. Loam soils, which contain equal amounts of clay, silt and sand, are considered the most fertile soils.

Knowing a little bit about the soils in your area will help in determining what kinds of plants to use for a Schoolyard Habitats project.

BEST COPY AVAILABLE

Preparation

1. Collect soils from your local area. Try to get examples of each soil type of varying particle size such as sand (largest), silt (medium) and clay (smallest). Be sure they are not from a polluted area and they do not smell unusual. Although different soils will make this activity most interesting, if it is not possible to collect three different-looking natural samples from the outdoors, use one from the schoolyard, one from store-bought potting soil and one from a mix of equal amounts of sand, potting soil, backyard soil and clay (use a very small amount of clumping kitty litter instead if no natural clay soil can be found). Place a cup or two of each type of soil in a Ziploc bag and seal.

Alternatively, have your students do the soil collecting after you have identified several good locations from which to sample.

2. Dry out soil samples on a newspaper in the sun or in the oven (use a baking sheet) at 250 degrees F for one hour.

3. Buy litmus paper, which tests for acidic or alkaline soils, at drugstores, school supply stores or through a biological or chemical supply house such as Carolina Biological Supply, www.carolina.com, or 800-334-5551

Procedure

1. Tell students that today they will study a part of habitats they do not often see – the soil. Create a learning chart with the class about soil, discovering what they know and what they want to know about soil. ***What questions do they have about soil?*** Generate a list. Discuss these questions. ***How could the students think of finding out the answers?***

2. Like climate, soil types vary around the world and play a role in determining the kinds of plants that can live in different areas. ***How do they vary?*** Find out by investigating. Pass out three Ziploc bags, each filled with a soil sample. Have them feel soil textures and observe color differences, using these directions:

- ❑ Feel the soil through the plastic bag. Is it sandy? Squishy? Spongy? Sticky? Does the soil feel uniform in texture, or are there clumps or pebbles in it? What word would you use to describe it? Tell the students that the quality of the soil on the schoolyard will be an important factor in determining what they can plant on in the Schoolyard Habitat.
- ❑ What color is the soil? What does it remind you of – chocolate, caramel, beach sand, a camel's fur? Write down an analogy to describe the color of the soil in your journal.
- ❑ Pour a small amount of each soil onto a piece of white paper. View the soil through a magnifier. Describe different soil ingredients in journal.

3. Have participants write how the three samples are different in a chart in their journals.

4. Divide students into small groups. Provide each group with a cup of each type of soil sample and a measuring cup with water. Have students measure exactly one cup of soil of each type into another cup. Then, have them measure exactly two cups of water. Students should add water slowly to each soil sample. After all the water has been added to each sample, ask students to measure how much water is left on top (not absorbed). ***How much water was each sample able to absorb?*** Record this information in notebooks.

5. Another characteristic of a soil is whether it is acidic or alkaline. Many plants grow better in alkaline soils, while some plants are adapted to living in acidic soil. For all three samples, do the following experiment to see whether the soils are acidic or alkaline.

- ❑ Put a spoonful of soil into a jar with a lid. Smooth soil with spoon so there are no lumps.
- ❑ Fill the jar about halfway with distilled water. Put lid on tightly and shake gently. Leave jar on a table for 5 minutes until the soil settles out of the water.
- ❑ Collect a small amount of the (clearer) water that's just above the soil on the spoon handle. Dab the sample of water from the spoon onto pieces of red and blue litmus paper. The paper strips should absorb water.
- ❑ One of the litmus papers should change color where the water was placed. The color change tells you if the soil is acidic or alkaline. If the red litmus turns blue with water, the soil is acidic. If the blue litmus turns red with water, the soil is alkaline.
- ❑ Have students record in the journals what they find for each soil sample. What does this mean about the kind of plants that can grow in this soil?

Modifications for Younger Children

1. Define soil and describe how soil forms. Take students outside to pick up soil and examine it. ***What do they notice?*** Draw a soil profile on the board and explain the different layers.

2. Compare three soil samples to identify soil layers and main ingredients. Fill a lidded jar halfway with soil and 3/4 with water. Have students shake jars and leave them on a flat surface for 10 minutes. Have students observe the different layers and try to identify humus, small soil grains and larger grains. Keep jars on surface overnight and observe the layers again the next day, when most particles have settled out.

3. Discuss each sample's ingredients and how they were formed. Ask: ***Which soil layer do plants grow in?***

Extensions

✔ Look at a map of the world that shows vegetation and soil types. Where are most crops grown? In what kinds of soil?

✔ What plants grow well in the soil at the schoolyard? Purchase soil kits to sample the schoolyard and/or borrow soil charts from your local cooperative extension agency to look up soil types on your schoolyard. Then start the search by looking in guides to local, native plants and/or talking with expert gardeners in the neighborhood or at a local nursery or arboretum about what will grow best there.

✔ Explore composting. Why do gardeners add the results of composting to their gardens? What does it supply for plants and soil creatures? How is it done?

✔ Soil erosion threatens to remove precious topsoil from farms, rendering them unable to support plants. Research techniques that help farmers conserve soil.

Assessment

✔ Have students draw a soil map of the schoolyard, labeling where they think different soil types can be found. This information will help them in planning for their Schoolyard Habitat.

ACTIVITY 8

Slopes and Puddles

Summary

Students participate in a demonstration of how water moves from high places to low places, use a variety of rolling toys to identify slopes on schoolyard, and go on a "puddle walk" to locate puddles and drains after a rainstorm.

Grade Levels: K-4; 5-8

Time: 45 minutes (1 class period) and 20 minutes follow-up after a rainstorm

Subjects: Science, Math, Geography

Skill: Analysis, comparison, classification, description, observation, research

Learning Objectives:
Students will be able to:

- Define concept of slope
- Identify slopes on the schoolyard
- Predict where puddles will form on schoolyard
- Draw slopes, puddles and drains on a map

Materials:

- Clay (enough to create a pie-pan sized model of a mountain)
- Plastic tub
- Cups
- Blank map of schoolyard
- Blue crayons, markers or colored pencils
- Various rolling toys (For younger students, use small toys such as toy cars and trucks. Older students might want to use a skateboard (although they will need to wear a helmet, knee pads and elbow pads if they ride it), roller skates or non-motorized scooter)
- Rulers
- Graph paper
- Pencils

Background

Water moves from higher places to lower places. Even a slight change in the elevation of the land can make a big difference. In a rainy area, just a few inches in elevation will mark the border of a swamp and a much drier land area called a wet prairie habitat. Just as the force of gravity pulls everything down toward the center of the Earth, gravity causes water to flow from the mountains to the sea.

The difference between the high place and the low place can be viewed as a slope – the height (or elevation) gained over a certain amount of distance covered. Imagine walking on a hill where for every foot you move forward, you move 2 feet higher on the hill. This trail would have a slope of 200% – a pretty steep walk!

When rain falls on the ground, it does one of three things: evaporates into the air, sinks into groundwater supplies or joins a waterway such as stream or river and flows down a slope to the lowest possible area. Waterfalls do this dramatically, but rivers and streams regularly make their way down steep and not-so steep land to reach a lower elevation. Water's flow explains the formation of watersheds, the networks of streams, rivers and other bodies of water that drain into a lake or ocean. The Mississippi River Watershed funnels water from a huge area from the Appalachian Mountains to the Rockies to the Gulf of Mexico.

Water rushes down huge mountains, flows down hills and trickles down even the very slight slopes of city streets, playgrounds and schoolyards. At these low points, water accumulates (entering the ocean or a lake or forming a puddle) or drains away (with water seeping down to underground water supplies or, in a city, entering the storm drain (which releases the water into the ocean). The water in puddles usually evaporates within a few minutes or days, depending on the climate.

Water moving down slopes can have dramatic effects and works to erode the land. Gardeners and farmers must be careful that the water doesn't erode the fertile topsoil that plants need to survive. Plants help to prevent erosion as their roots stabilize soil and slow down the flow of water, allowing more water to sink into the soil. On the other hand, placing a garden or farm too low in elevation may threaten the plants grown there. If water pools in a garden (and doesn't drain through the soil) it can become flooded. Too much water can kill plants not adapted to an aquatic environment, as land plants and soil creatures require air in the soil to survive.

Observing topography will assist in choosing the best site for your habitat project.

Preparation

1. Use clay to make a pie-pan sized model of a mountain in the plastic tub. Use this as a demonstration.

2. Find an area of the schoolyard with the most slopes or use the entire schoolyard.

3. Draw a simple map of the schoolyard or the area of the yard that will be investigated in this activity on a sheet of paper. Older students can do this step themselves. Make one copy for each student. Include buildings on the map.

BEST COPY AVAILABLE

Procedure

1. Bring out the clay mountain model and show to students. Ask them what they think will happen if water is poured on top of the mountain. ***Where will the water go?***

2. Invite students to investigate. Provide cups and water or a spray bottle to simulate rain. ***Does the water always go where children predicted?*** Ask them to provide an explanation of the why the water flows downhill. Older students may be familiar with gravity and can apply the concept to this situation. This is a good opportunity to introduce the idea to 3rd graders and above. Younger children may only be able to understand that water always runs from high places to low places. Challenge students to find a way to move water from a low place to a high place. ***Is it easy or hard? Are there any times that water runs uphill?*** (Generally, this is possible only with human help).

3. Discuss water erosion, including the idea that water wears down mountains and that water can create geologic features such as canyons, fertile flood plains (such as the Nile River Valley) and river deltas (like the Mississippi Delta). Erosion can also lead to the loss of fertile soils for farmers. Plants help protect against water erosion.

4. Tell students that now they will investigate how and where water might move on the schoolyard. They will use these findings later when they start the Schoolyard Habitats project. To figure out the path of water, they will need to locate places with slope on the yard. Define slope for students using the example in the background of a trail with a 2/1 slope. Have them draw this on graph paper. On the schoolyard, students will locate slopes by using rolling toys, which move from high points to low points much like water.

5. Before going outside, distribute pencils, blue pencils/crayons and blank maps of the schoolyard to each child. The students need to find an area that has a slope using the rolling toys provided. When they find a slope they should mark on their maps (with a blue pencil). Tell students that just as they saw in the mountain demonstration, water always flows from high to low. On the schoolyard, identifying slopes tells students where water might flow if it rained. They may be able to predict where puddles will form as well. They should note where the rolling toy (or a skateboard, etc.) stops after rolling down the slope. Ask them to figure out if this might be where water forms a puddle or if they think a puddle will form in another place, marking these spots on maps as well. (This process will not always yield accurate results. The less force students use to start the toy rolling and the less the toy weighs, the better this will work as a predictor of puddles.)

6. After the next time it rains, take students on a puddle walk around the school grounds. ***Where did the water pool and form puddles? Are these the same areas students predicted on their maps? Were there puddles students had not predicted?*** If so, have them investigate these areas again. ***Is there a slight slope that they did not notice the first time?*** They can use a rolling toy to test. ***Are there places where they predicted there would be puddles where there are none?*** (Check these areas for drains and note any on the map.) Have students update or re-do maps to show slopes, puddles and drains on the schoolyard. If there are no rainstorms, use a hose or buckets of water to experiment with slopes and puddles.

Modifications for Older Students

1. Have students measure slope by placing the end of a meter stick on the slope and holding it level. Place a jar of water on it to be sure it stays level.
2. Measure the distance from the ground to the end of the level meter stick not resting on the ground. That measurement from the ground is the rise. The meter stick (100 cm) is the run.
3. In the classroom, calculate the slope: Rise/Run = % slope.

Extensions

✔ Research the reasons for the huge losses of topsoil from farms in the last century. Are farms in trouble? What methods are farmers using to minimize the loss of topsoil? What other physical factors cause soil erosion?

✔ Identify the watershed of the local region. Where does the water eventually drain?

Assessment

✔ Evaluate students' maps and conclusions about where to plant a garden to minimize water erosion.

BEST COPY AVAILABLE

ACTIVITY [redacted]

Wind Power

Summary

Students create a model of a wind-dispersed seed.

Grade Levels: 3-4, 5-8

Time: 30-45 minutes (1 class period)

Subjects: Science, Art

Skills: Analysis, application, comparison, construction, evaluation, observation, problem-solving, research

Learning Objectives:
Students will be able to:

- Describe four ways that plants disperse seeds
- Explain why plants disperse seeds
- Recognize that wind is a part of the physical environment
- Describe one way that the physical environment is connected to living things
- Create a model of a wind-dispersed seed
- Design an imaginary wind-dispersed seed and compare it to a model of an actual seed (Grades 6-8 only)

Materials:
- Posterboard or other thin cardboard
- Scissors
- Modeling clay
- Color markers
- Ruler
- Pencil
- Pictures or real samples of wind-dispersed plants and seeds
- Strong electric fan (optional)
- Linden Seed Helicopter Sheet, p. 29

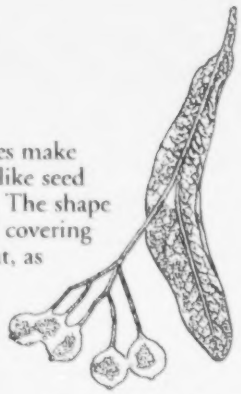
Background

For the next generation of plants and trees to flourish, a parent plant tries disperse its seeds far from itself. That's because young seedlings could become competitors with their parent for basic survival needs such as sunlight (to make food) and water. In this competition, the seedlings often lose. A tree that drops seeds directly below its boughs may block the sunlight that its offspring need to grow. Plants have solved this problem through a number of interesting adaptations.

Plants can't move, but they do have ways of scattering seeds as far from the parent as possible. Some seeds may even end up more than a hundred miles away from the parent tree. One way, used by foxtails, is to stick to the fur of animal passers-by. Covering seeds in a tasty fruit is another method used by fruit trees and berry bushes. The fruit meal attracts animals like birds and bats, which fly the inedible seeds to a new location. Likewise, the seed of the oak tree is found inside an acorn, which squirrels collect, eat and distribute. Pine cones hold seeds for some trees.

Catkins hold tiny seeds that can float in the wind or in water. Other plants place seeds in pods, which burst open and eject seeds away from the parent plant. Trees like the maple and linden have seeds with wings and rely on the power of the wind to carry the seeds away from the parent.

Wind is part of the physical environment that affects living things. Some plants' reliance on wind to scatter seeds shows how physical factors can become intertwined with the living community of plants and animals.



Linden trees make helicopter-like seed containers. The shape of the seed covering ensures that, as the seeds drop from the trees, the seeds will spin like helicopter blades. This helps seeds stay aloft longer. Pushed by strong winds, the seeds can travel far. Birch trees wrap their seeds in the folds of a catkin that opens to the wind when the tiny seeds are ripe and dandelions form very small, light filaments shaped like parachutes that lift and float in the wind. Thistles develop fluffy hairs easily picked up in the wind. Maples have wing-like flaps that allow the seeds to spin like helicopters (much like the Linden seeds) and help the seeds travel farther.

Preparation

1. Copy the illustration of the Linden seed "helicopter" for all students.

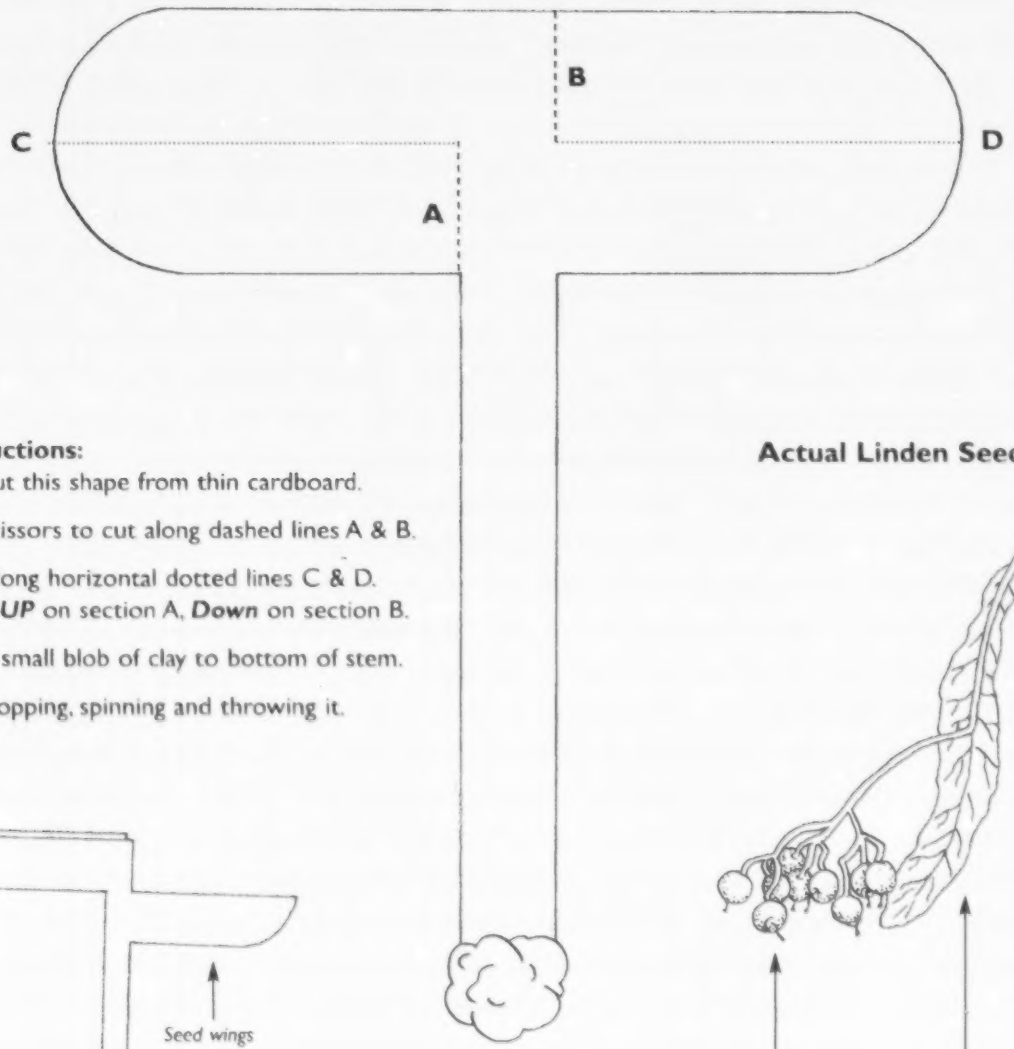
2. Find out which local plants use wind to disperse seeds. Collect a sample if possible.

Procedure

1. Review the idea of habitat and the four basic elements all living things require to survive: food, water, cover and places to raise young. ***How do these needs apply to plants?*** While earlier activities explored how plants get the food and water they need, understanding what it means for a plant to find places to raise young may prove difficult. Start this activity by asking students how they think plants meet this survival need.

BEST COPY AVAILABLE

Linden Seed Helicopter



Instructions:

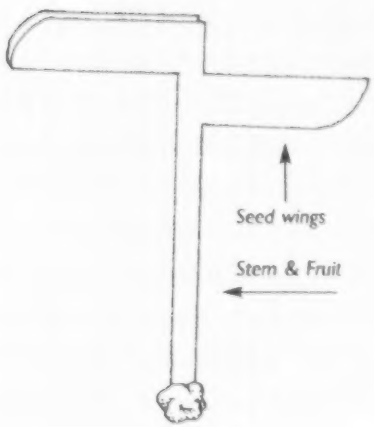
Cut out this shape from thin cardboard.

Use scissors to cut along dashed lines A & B.

Fold along horizontal dotted lines C & D.
Fold ***UP*** on section A, ***Down*** on section B.

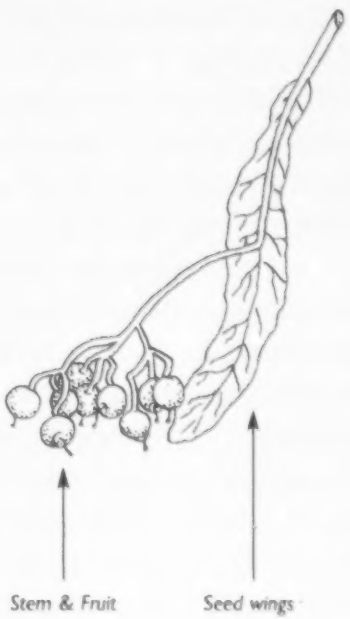
Add a small blob of clay to bottom of stem.

Try dropping, spinning and throwing it.



Modeling clay

Actual Linden Seed



Ideas for other wind-dispersed seeds – Sycamore, Dandelion, Birch, Locust, Thistle, Maple.

Illustrations Copyright Jennifer DiRubbio Lalinsky 2001

© Copyright 2001 National Wildlife Federation

2. Explain that all plants must scatter seeds as far away from themselves as possible to give offspring the best chance for survival. Ask students to brainstorm some plant strategies to accomplish seed dispersal. ***Why are different strategies used?*** Review ideas of animal dispersal (fruit and burrs and foxtails that stick to animals that pass by), plants ejecting seeds from pods and seed dispersal by wind.

3. Show pictures or real flowers/seeds to illustrate these ideas. You can use the examples on page 30 for this purpose. Have students look at each sample and predict how seeds are dispersed.

4. Tell students that they will make a model of a floating seed from a linden tree. Pass out copies of the linden seed "helicopter" and other materials and follow these instructions:

- ❑ Cut out the T-shape
- ❑ Carefully cut along line marked "A". Be sure to cut only halfway through top section.
- ❑ Carefully cut along line marker "B".
- ❑ Fold along line "C" and "D" to form the seed wings.
- ❑ Decorate seed with wings
- ❑ Add a small pinch of modeling clay to bottom of seed stem to represent the seed. This will give the "helicopter" weight so that it will land.

5. Go outside to test the Linden seed models. Try to spin them before letting go. ***How far did the models travel in the wind?*** (Older students should record their findings.)

6. Discuss any questions students may have. Review main methods of seed dispersal. Ask, ***why do plants scatter seeds?***

Modifications for Older Students

1. Follow steps above. Then, challenge students to design their own plants with seeds adapted for wind dispersal. They will need to draw and then make a model of the seed and its cover. After they make a model, students will compete to see which design travels farthest in wind or in front of a powerful fan. Have students research different seeds dispersed by wind, such as: daffodils, thistles, poppy flowers, maples and birch tree catkins. Include any local plants identified with wind dispersal of seeds.

2. Allow the class a set time to create, test and revise models. Test models with wind or a fan. Record how far each of the models travels. Back in the classroom, compare distance of all models (including the Linden seed model). ***Which travels farthest? Why?*** Do research to see if any of their designs are similar to those in nature.

3. Ask students to conduct research to investigate the evolution of seed dispersal, or methods invasive plants use for seed dispersal. Are they different from methods used by native plants?

Extensions

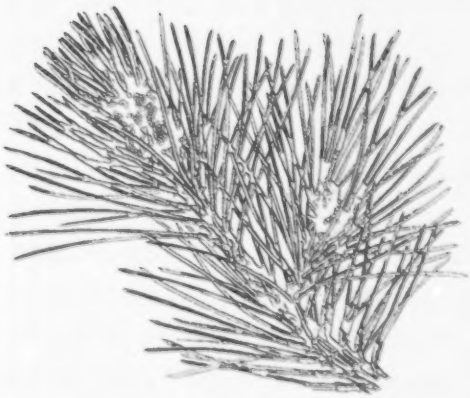
✔ Either during a field trip to the schoolyard, other natural area or as homework, have students collect different types of seeds from the ground (one per type). Back in the classroom, have students sort the seeds by how they think the seeds are packaged and dispersed (wind, stick to animal, fruit (animal distributed), nut (animal distributed), pod ejected, in a cone, in a catkin or other.) Then have them do research to find out how each species disperses its seed. A local native plant society may provide helpful information.

✔ Plants produce huge numbers of seeds. Few of these seeds grow into mature adults. Does the number of seeds a plant produces vary according to what kind of seed dispersal strategy the plant uses? Compare how many seeds the following plants (each uses a different strategy to scatter seeds) produce each year: maple tree (wind); foxtail grass (sticks to passer-by); locust tree (pods burst and eject seeds); peach tree (animal eats fruit and disperses seed). Is one method more reliable than the others?

Assessment

✔ Have students make a poster of their own seed, with a drawing and description of it, pointing out different features of the seed, how it is dispersed, and why it works.

POLLINATION STRATEGIES



© Copyright 2001 National Wildlife Federation

ACTIVITY 11

Food Chain Mania

Summary

Students play a game of tag in which they assume the roles of members of a marsh food chain.

Grade Level: 3-8; K-2

Time: 1 class period (30-45 minutes)

Subjects: Science, Physical Education, Math

Skills: Analysis, application, evaluation, generalization

Learning Objectives:
Students will be able to:

- Define food chain, producer, primary consumer and secondary consumer
- Explain how energy travels through food chains
- Recognize that all animals depend directly or indirectly on plants for food
- List three trophic levels in a food chain
- Explain the relationship between trophic level and population size

Materials:

- Cutouts of animals, pp. 35-36
- Cloth sashes, survey tape, or yarn cut to about 40 to 100 cm (inches). Sashes should be in three different colors, for example green (color 1), black (color 2) and yellow (color 3). To determine the number of sashes needed in each color, calculate that you will need to make enough sashes for 3/4 of the class in color 1, sashes for 1/3 of the class in color 2 and sashes for 1/3 of the class in color 3. There will be extra sashes because some students will change their roles during the game.
- Plastic sandwich bags (1 per student)
- Pipe cleaners, toothpicks or popcorn
- Data Board
- Marking Pen
- Kitchen Timer (with bell)
- Masking Tape

Background

The previous activities focused on how plants and animals interact with the physical environment, such as heat or cold, light or shade. Relationships between living things represent an equally important part of a habitat.

Living things take in or make food to get the energy they need to survive. A food chain shows how energy passes from the sun to a plant and on to animals within an ecosystem. Food chains show who eats whom in a habitat. Plants use the energy in sunlight to make their own food, storing that energy in the form of sugars. Consumers eat plants or other animals to get energy.

In order to understand food chains, think about a mouse. *What does a mouse eat? It eats seeds. What eats a mouse? A snake.* The food chain can be visually represented using diagrams like the one below.

In this simple food chain, plant seeds are the producers. Green plants are called producers because they make their own food from the sun's energy. Animals (consumers) eat the producers. The mouse is a primary consumer, since it eats seeds and appears next in the chain. The snake is a secondary consumer since it eats primary consumers and is next in the food chain. A hawk that eats the snake would be a tertiary consumer. Each link in the food chain is called a tropic level. Land-based food chains rarely have more than four tropic levels. Aquatic-based food chains may be as long as five or six. *Why can't food chains go on forever?*

The answer has to do with energy efficiency. Each organism in an ecosystem belongs to a trophic level. Producers are in the first trophic level, primary consumers in the second, and so forth. The amount of energy reaching each trophic level depends on the amount of energy stored by an organism and the amount of energy lost to the environment.

A large portion of energy is lost between each level or link on a food chain. For example, assume marsh reed grass absorbs some 200,000 calories (units of energy) from sunlight. It uses 90% of those calories to maintain its body processes. A grasshopper eating the grass gets the remaining 20,000 calories. The grasshopper spends 90% of that energy staying warm and maintaining its life processes and so passes on only 10% of the energy to the next link in the food chain, a spider. The orb-web spider that eats the grasshopper gets only 2,000 calories, and passes on only 10% of that energy to the robin that eats it. The bird receives only 200 calories. The bird must eat a lot of spiders to get all the energy it needs.

BEST COPY AVAILABLE

Preparation

- ❑ Make sashes (see Materials for information on how many of each color).
- ❑ Mark off an outdoor lawn or play area at least 15 yards per side. (Older students should play on a larger area; younger may need a smaller area.) Spread pipe cleaners or other item (popcorn or toothpicks) around the area.
- ❑ Place a strip of masking tape #1 to 2 inches up from the bottom of each plastic bag.

Procedure

1. Ask students, ***What is a food chain?*** Help students understand that a food chain shows who eats whom and that every living thing is involved in at least one food chain, including humans. Mention that the relationship between two animals in a food chain is also called a predator-prey relationship. Hand out the animal worksheets to groups of students and have them cut them apart and connect them in a chain, predicting which ones will eat the others. For more advanced students, have them research local food chains.

2. Before leading children outside, tell them they will play a game of tag in which they will pretend to be the different animals in a food chain. Although food chains exist in habitats all over the world, in this game the class will simulate a food chain found in a marsh (Explain that a marsh is a type of wetland). A food chain can be drawn like the one below.

3. Tell students that pipe cleaners (or other objects) placed on the play area will represent the marsh grass. The students will be grasshoppers, spiders or birds. The plastic bags will represent the animals' stomachs.

4. Divide the class into 3 even groups. Give each group sashes so that each group has a different color. Each student should also have a stomach (plastic bag). Have them tie sashes around their waists.

5. The group wearing sashes in color 1 (see Materials for explanation of sashes) are the grasshoppers; those in color 2 (black) sashes represent orb-web spiders; and those in color 3 (yellow) are robins. In this game, grasshoppers only eat grass, spiders only eat grasshoppers and birds only eat spiders.

6. Once at the playing area, review the boundaries of the game. Explain that the goal of the game is to either pick up the food (for the grasshoppers) or to tag the food (for spiders and birds), while trying to not be tagged yourself. Grasshoppers will pick up pipe cleaners from the ground and place in their stomachs (bags). When a spider tags a grasshopper, the grasshopper gives the spider all of its food (whatever is in the plastic bag) and "dies" (sits out the rest of the round). When a bird tags a spider, the spider gives up the food in its "stomach" and "dies." Everyone who dies will be able to rejoin the game in the next round.

7. Set the timer for 5 minutes for the first round. Shout "Go!" The first round usually ends very quickly, because there are so many secondary and tertiary consumers in the game. All the grasshoppers will probably be tagged before they collect enough pipe cleaners to survive and all of the spiders will probably "die" before they can tag enough grasshoppers.

8. Take a few minutes to discuss what happened in the first round. ***How many animals survived? What challenges did they face?*** For a grasshopper to survive, its stomach must be filled to the bottom of the tape (1-2 inches). For a spider to survive, the stomach must be filled to the top of the tape. (Remind students that spiders need to eat more because they get less energy from each thing they eat.) Birds must have captured the equivalent of one spider to survive (their stomach should be filled to the top of the tape).

Write down how many of each animal survives each round. Return pipe cleaners to activity area after each round.

8. Change a rule for each replay to find a better energy balance in the food chain. Suggestions include:

- ❑ Alter the ratio of grasshopper: spider:bird from 1:1:1 to 3:2:1. Try it again with a ratio of 10:3:1. (This is closer to the populations found in nature. As you move up the food chain, the number of animals at each level declines, so there are many more grasshoppers than spiders, and more spiders than birds. This is due to the huge loss of energy at each link in the food chain).
- ❑ Enlarge the playing field. (so each animal is more rare, making it harder to find food and fewer animals survive).
- ❑ Provide a safe zone or base where grasshoppers and/or spiders can't be tagged. (This represents hiding places).
- ❑ After all the rounds, analyze during which round the most animals survived. ***How was the game similar or different to a food chain found in nature?*** (The game is much less complex. It also may be easier to tag each other than it is to hunt food. Another answer might be that there was no reproduction so no new animals replaced those that were eaten.) ***What happens to the energy as it travels through the food chain?***

Modifications for Younger Students

1. Read Who Eats What? Food Chains and Food Webs (*Let's-Read-And-Find-Out Science, Stage 2*) by Patricia Lauber (illustrated by Holly Keller), HarperCollins Juvenile, 1995. Have students do drawings or collages showing a food chain in which each kind of living thing is inside the stomach of another. Use a food chain showing a seed, mouse and hawk to make it simpler to draw.

2. Do an activity exploring how humans fit into food chains. Use milk as an example of a food chain that humans are part of (energy passes from grass to cow to humans) and diagram it on the board. Have students think about one type of food they ate recently (an apple or a hamburger for example) and create a simple food chain diagram. Help them to identify other plants and animals in the food chain if they do not know.

Extensions

✔ Add 1 colored pipe cleaner for every 10 white ones. The colored pipe cleaners represent toxic pollutants in the environment. Do not tell students about the colored pipe cleaners. Run the game for a couple of rounds. At the end of a round, ask the survivors to examine the contents of their bags and see how many colored pipe cleaners they have in their "stomachs." Now tell them what those represent, and ask them to explain that the more colored pipe cleaners they have, the greater the chance that their bodies will be affected by the pollutants and their offspring may have difficulty surviving. Students should notice that the predator animals, birds and grasshoppers, have more of the "toxin" in their bodies. What does this mean to the wildlife? Students should recognize that even small amounts of pollutants can affect wildlife because they accumulate in the their bodies over time.

Assessment

✔ Have students create a new food chain, based on animals they see in their schoolyards or neighborhoods. Use arrows to indicate the direction of the energy flow. After students have created independent food chains, have them work in groups to try to connect theirs with those of other students, so that they create a food web of their own local ecosystem.

Example: Forest Trophic Levels

Sun

Plants (producers): moss, wildflowers, poison ivy, oak tree, pine tree

Insects/spiders (primary consumers): ladybug, bumblebee, wasp, earwig, spider, butterfly

Reptiles or amphibians (primary or secondary consumers): lizard, frog, snake, turtle, salamander

Songbirds (primary or secondary consumers): robin, sparrow, finch, warbler, blackbird

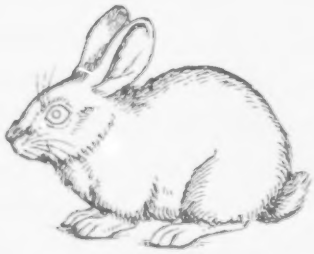
Raptors (secondary or tertiary consumers): kestrel, hawk, eagle, kite, vulture

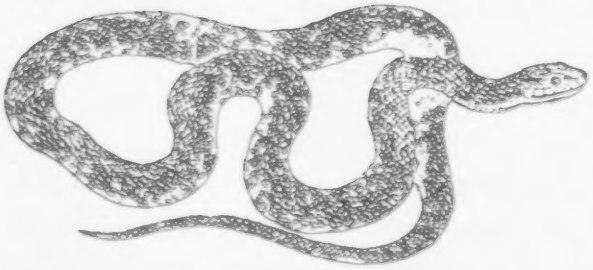
Herbivorous (primary consumers) mammals: mole, rabbit, deer, elk,

Carnivorous (secondary or tertiary consumers) mammals: otter, weasel, bobcat,

Decomposers: fungus, earthworm, dung beetle

Non-living components of the food web: water, air, soil

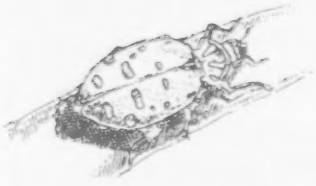




© Copyright 2001 National Wildlife Federation

ACTIVITY

WORKSHEET



© Copyright 2001 National Wildlife Federation

Bluebird Madness

ACTIVITY

Summary

Students learn about habitat loss, predators and competition through an outdoor game about the bluebird.

Grade Level: 3-4; 5-8; K-2

Time: 30 to 45 minutes (1 class period)

Subjects: Science, Physical Education, Math

Skills: Analysis, application, evaluation, observation, research

Learning Objectives:
Students will be able to:

- Define habitat loss, competitor and introduced species as used by biologists
- Identify the effects of competition on species survival
- List three reasons for the decline of the bluebird population

Materials:

- Playground suitable for hopscotch game
- Straws
- Index cards or construction paper
- Yarn or string
- Marker
- Chalk or masking tape to mark boundaries
- Large blocks or other sturdy objects

Background

Bluebirds are not officially endangered but they are several of many species of North American songbirds that have suffered a steep population decline over the last 40 years. There are three species of bluebirds, and at least one is found in every state in the United States except Hawaii.

Many factors have contributed to the decline in bluebird populations. Severe winters, unintended effects of the pesticides used to control fire ants often found in the bluebird's habitat, habitat loss and degradation, and competition with introduced species for nesting sites. (See Background section for more information on introduced species and habitat loss.)

In their native habitat, bluebirds nest in tree holes that have been carved out by previous occupants, such as woodpeckers. When humans remove dead, diseased and hollow trees from the habitat, a common practice of modern forestry management, they also remove the bluebird's cover and place to raise young. Some bluebird habitat has been lost to logging and development.

Introduced species, such as the European starling and house sparrow, make the situation worse since they compete with bluebirds for the same nest sites.

Bluebirds recognize a good nesting site when they see other bluebirds nearby. In winter, they join large flocks (with 10 to 50 birds), but stay in family groups at other parts of the year. Only a small number of bluebirds migrate south in winter, depending on how cold their habitat gets and whether food is available. Bluebirds hunt from perches, dropping down quickly to gobble up grasshoppers, spiders and fruit. Bluebird habitat must have open grassy areas and perches for hunting, in addition to suitable nest sites.

Many citizens and conservation organizations want to halt the decline of bluebirds before these songbirds become threatened or endangered.
People concerned about the bluebirds have started building bluebird boxes in the bird's habitat. The boxes help provide shelter. Already in some regions bluebird boxes are credited with helping bluebird populations bounce back.

In this game, students will take on the roles of bluebirds and their competitors, the European starling, to try to survive and reach a good nesting site.

Preparation

1. Create two parallel hopscotch

BEST COPY AVAILABLE

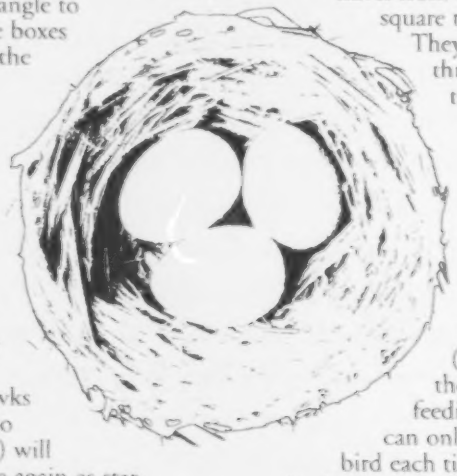
courses in an outdoor area, one for bluebirds to use and one for starlings. Make sure the courses are separated enough so students do not bump into each other. On the bluebird course, cross off two squares to represent habitat loss due to development and the removal of trees. Students cannot step on crossed-off squares during the game.

2. Use chalk to mark off a square area (about 5 yards per side) on the far side of the hopscotch courses. Both hopscotch courses should feed into and end at this same square area. The square represents a feeding area in which you will place "food" that bluebirds will try to get before their competitors do. Place straws (to represent insects and spiders) into the square just before the game begins. Beyond the square, draw a large circle (about 5 yards in diameter) to represent a bluebird nesting area. Scatter 10 blocks (or another object that won't blow away) around the circle to represent suitable nesting sites.

3. For a class of 25, use index cards or construction paper and yarn to create name tags for the different types of birds. Make enough bluebird cards for 20 students; create starling cards for 15 students; and create hawk cards for 3 students (they will prey on the bluebirds but not the starlings). To start with, there will be 12 bluebirds, 6 starlings and 1 hawk (approximately a ratio of 6:3:1/2).

4. During the game, both bluebirds and starlings will have to travel through the hopscotch courses (this represents their search for a suitable habitat), find 3 straws (to represent insects that the birds feed on) and then find an unoccupied block (a nesting site, only one student per block). Bluebirds will have to face more obstacles than starlings. They will have to jump over crossed-off squares on the hopscotch course (habitat loss) and may be eaten by a hawk in the feeding area. Starlings can live in many different kinds of habitats, and as an introduced species, have no natural predators in the habitat, so they are not affected by these same losses.

Any starlings that cannot find a nesting site will become bluebird boxes, the artificial nest sites built by people. Have students hold their hands over their heads in a triangle to show they are boxes and stand in the nesting area. These are now "safe" houses for bluebirds. All bluebirds that do not make it to a nesting site (because they were either tagged by hawks or there are no available sites) will start the game again as starlings.



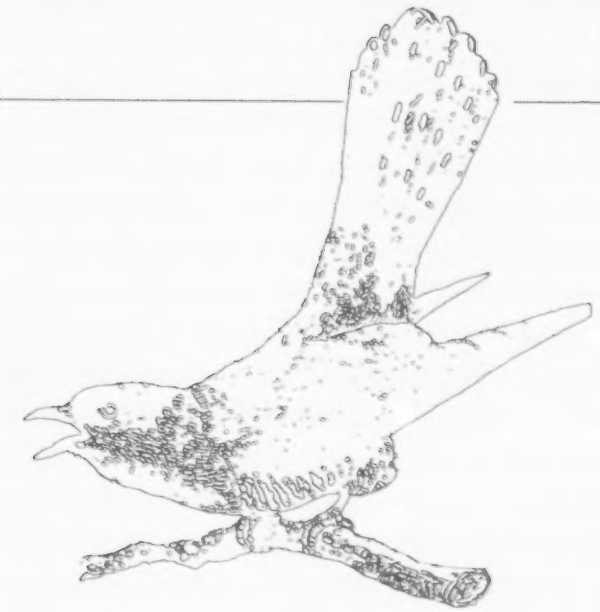
Procedure

1. Introduce students to the plight of bluebirds, their habitat requirements, and the threats they face today. Ask students to brainstorm what an introduced species is and how it can harm native species, (often through competition). Then tell students that they will play a game in which bluebirds will compete with an introduced bird species, starlings, to survive and find a nesting site.

2. To start the game, have one bluebird and one starling start at the same time on each of the hopscotch courses. Tell them that all of the birds are looking for a new habitat and the hopscotch course represents the journey. Bluebirds aren't allowed to step in crossed-off squares.

3. Students who successfully make it across the course must try to get food. In the square (the feeding area), bluebirds and starlings can pick up one straw at a time (food) each time they travel from one end of the square to the other. They must pick up three straws total to have enough food to eat and to move on to the nesting area. However, bluebirds must try to dodge the hawk that will try to "eat" (tag) them while they are in the feeding area. Hawks can only tag one bluebird each time they enter the feeding area. Before they can tag another, they must exit the feeding area, count to ten, and then they can return. Tagged bluebirds become starlings and start the game over.

4. Real bluebirds must compete with starlings for the rare nest spots in their habitats. All birds that make it into the nesting area must grab a block (repre-



senting a nest). These students are the surviving birds. Starlings that cannot find nest sites become bluebird boxes. If there are no blocks left, any remaining bluebirds can try to find a student who has become a bluebird box. These students will also be survivors once they have made it to the nesting site and found a box. Stop the game after about 15 minutes or after there are no more resources (food and nest sites) left.

5. ***How many bluebirds survived? How many starlings survived? If you repeat the activity with more students on the bluebird team, how does the survival rate change? What if there are more starlings?*** How about pretending that hawks also hunted starlings - how would that change the survival rate? What would happen if more nesting sites were added?

6. Back in the classroom, discuss the different obstacles faced by bluebirds today. ***Which obstacles in the game were the most difficult to survive? What are the effects of competition with introduced species on bluebirds?*** Have students research other obstacles that bluebirds face and other reasons for their decline (see Background section).

Modifications for Younger Students

1. Use pictures and sounds of bluebirds to discuss the bluebird habitat and survival needs. Then show pictures of a European Starling and explain introduced species, competition and the decline of the bluebird population.

2. Explain that there are many reasons for the decline, but that today the class will focus on just one of the causes – competition. In the game, concentrate only on competition for food or competition for nest sites. Eliminate the hawk role and the habitat loss on the hopscotch course.

Modifications for Older Students

1. Do the activity and then research the current status of Eastern bluebirds or another local songbird. ***What are some of the other reasons for their declines?*** Building bluebird boxes and trails is one way that some people are trying to conserve the birds and their habitats. ***What are some other ways? Why are so many songbirds facing declines in populations? Is this a trend?***

2. Have students design a new game that involved interaction of another local bird species native to your area.

Extensions

✔ Change one variable (i.e. cross off another square to show more habitat loss or add more food) and see how it affects the number of bluebirds that survive. Add a water component to the game.

✔ Play the game three times. Determine the average number of bluebirds surviving each game. Express (in percentages) the portion of the population lost during the game. ***How many offspring would the bluebird population need to produce each year to replace those lost?***

✔ ***What other species of songbirds live in your area? What habitat requirements do they have?*** Explore your schoolyard to see if those components are present, or if you could add them as part of your schoolyard habitat project.

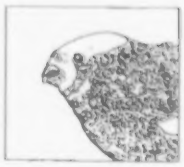
✔ Help support local bluebird populations by building bluebird boxes. Visit www.nabluebirdsociety.org for more information.

Assessment

✔ Have students, working in small groups, design a newspaper to distribute to other students on the bluebirds, with articles, photos, editorials and advertisements focusing on the bluebird's situation and what students and their families can do to help the bluebirds.

ACTIVITY 12

Fill the Bill



Summary

Students learn about bird feeding adaptations by using a variety of tools to simulate eating different foods.

Grade Level: 3-8, K-2

Time: 1 class period (30-45 minutes)

Subject: Science

Skills: Analysis, application, classification, comparison, generalization, observation, problem-solving

Learning Objectives:
Students will be able to:

- Describe five different types of bird beaks
- Identify the most efficient tool to use with each type of food
- Compare how different tools can function like different types of bird beaks
- Explain how each type of beak is adapted to feed on specific foods

Materials:
- Copies of handouts, p. 42, or pictures of birds with different kinds of beaks
- 3 eyedroppers or straws
- 4 pairs of chopsticks
- 3 nutcrackers or pliers
- 2 large scoops or slotted spoons
- 3 strainers
- 3 envelopes or small fishnets
- 3 forceps or tweezers
- 3 tongs
- small log
- pennies
- paper clips
- seeds
- push pins
- string
- water

Background

It would be impossible for a hummingbird to gobble up a mouse and it would be just as difficult for a hawk to fit its large beak into a flower to slurp up nectar. Different bird species have beaks and tongues adapted to eating a certain types of food. Some birds have beaks good for tearing and others can use their beak to crack open hard nut shells.

Species are adapted to the environment where they live. That's partly why protecting habitats is so important – a species is perfectly adapted only to its own habitat components: food, water, cover, and places to raise young. (See Adaptations in Background section). Bird beaks are an easy-to-see example of species adapting to the kinds of food they eat. Some examples include:

- ❑ Hummingbirds have long hollow beaks to probe flowers for nectar. The beak protects the tongue, which slurps the nectar.
- ❑ Curlews, godwits, kiwis, and snipes have very long beaks that to probe for worms, crustaceans and other small creatures in mud and water.
- ❑ Cardinals, sparrows, grosbeaks and other finch-like birds have very short, cone-shaped beaks. These beaks are very strong and can break open tough seeds.
- ❑ Spoonbills and pelicans have long, flattened or pouch-like beaks that they use to scoop up fish and other aquatic creatures.
- ❑ Flamingos and some ducks have bills that act like strainers to filter tiny plants and animals from the water. (Only certain kinds of ducks are filter feeders.)
- ❑ Nighthawks, whip-poor-wills, swifts and swallows have large gaping mouths that act like nets to trap insects. These birds catch insects flying through the air.
- ❑ Warblers have small, sharp, pointed beaks for picking insects from leaves, logs and twigs.
- ❑ Toucans have very long, thick beaks for reaching out and plucking fruit from trees.

Preparation

1. Collect all materials for the activity. Set up a large sheet or tarp on the playground or in a large empty place in the classroom.

2. Scatter all the small objects around the tarp.

3. Photocopy the handout provided, one for each student.

Procedure

1. Pass out handout (or pictures of different birds, if available) showing different bird beaks to students. Ask students what they notice about the shapes of the beaks. *Are they all the same? What do birds do with their beaks? How does the beak help birds survive?* Talk about some of the examples of different bird

BEST COPY AVAILABLE

beaks discussed in the Background section.

2. Hand out the tools, and small plastic baggies, and instruct students to pick up as many objects as they can in 30 seconds, using only their tool.

3. Time the students and have them count up the different types of objects, and then put them back.

4. Have students switch tools with one another so they all have different ones this round.

5. Repeat the 30-second activity.

6. Have students count up their objects again. ***What did they discover about their tools?*** Discuss the benefits and disadvantages of each tool in picking up different foods.

7. Afterwards, ask students how the tools they used relate to real bird beaks pictured on the handout. Do any have similar shapes? Discuss this with students before having them match the tools with the beaks on the handout. Underneath each bird picture on the handout, have students write the letter of the tool that best matches the beak. Ask students, ***What do you think would happen to a bird that ate nectar if it had the beak of a cardinal (which eats seeds)? Would it be able to survive?*** Have students also make a hypothesis about what each bird actually eats and write it next to the bird. ***How might they discover the answers?***

8. Discuss beak adaptations in general. Explain that many birds, after millions and millions of generations, have evolved very specialized beaks. The beaks allow the birds to eat a certain kind of food. Ask students ***How do you think a specialized beak helps birds survive?*** (A bird with a specialized beak may be able to eat a type of food that no other bird can eat). ***Could they imagine a situation in which it might actually harm the bird to have such a specialized beak?*** (If the bird's habitat changes and its food is no longer available, the bird might die because it can't eat anything else.) Point out that not all birds have such specialized beaks. Crows, for example, can use their beaks to eat a variety of foods, like fruits, nuts, berries, dead animals, fish and small rodents. Crows are generalists, and if one type of food is not available they can easily eat something else.

Modifications for Younger Students

1. Set up four stations around the classroom. Copy the pictures of four of the birds (to match the stations you've chosen) onto the chalkboard. Lead students from looking closely at the beaks to investigating and testing the tools at the station.

2. Begin discussion by telling students that there are many different kinds of bird beaks. Have them look at the beaks and ask how the beaks look different from each other. ***What do birds use a beak for? Why might different birds (who live in different habitats) have different shapes of beaks?***

3. Start with one bird and describe ask students what they think it eats. Have the class focus attention on the matching station and provide two tools (one that works and one that doesn't) for students. Have two students come and test both tools (give each a chance with the correct tool). After they have both tested both tools, have them tell the class which tool they think works best. Direct attention back to the picture of the bird beak. ***How is the correct tool like the beak? How is the incorrect tool different from the beak?***

4. Repeat for the rest of the stations.

Extensions

✓ Have older students research birds with a focus on their beaks. Challenge them to find the most specialized and most generalized beaks. What is it about these birds' habitats that has led to this kind of beak adaptation??

Assessment

✓ Have students go out to the schoolyard to look for birds and direct their attention to their beaks. What do their beaks tell you about what they eat? Have students hypothesize what each type of bird eats and then design an experiment to test their hypothesis. Does your schoolyard provide those types of food items? Could it?

ACTIVITY

WORKSHEET

Fill the Bill

Directions: How are birds adapted for eating different kinds of food? Match the following tools with the bird beaks below.

A - Tweezers

E - Nutcracker or Pliers

B - Strainer

F - Fishnet

C - Straw or Eye-dropper

G - Meathook

D - Scoop

H - Tongs

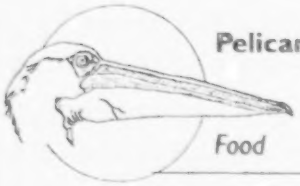
Illustrations above: Copyright Jennifer DiRubbio Lobinsky 2001

Whip-poor-will ____

Food _____

Snipe ____

Food _____



Pelican ____

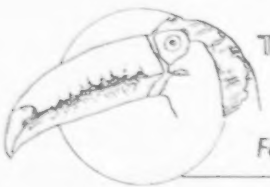
Food _____

Hummingbird ____

Food _____

Warbler ____

Food _____



Toucan ____

Food _____

Grosbeak ____

Food _____

Flamingo ____

Food _____

Based on its beak, what do you think each bird eats in the wild? Write down your hypothesis next to each drawing. How will you find out if you are right?

© Copyright 2001 National Wildlife Federation

Schoolyard Biodiversity

ACTIVITY

Summary

Students will estimate the biodiversity of the schoolyard (or other site) by sampling the number of species within a small area.

Grade Level: 3-8, K-2

Time: 1 to 2 class periods (60 minutes)

Subjects: Science, Math, Social Science

Skills: Analysis, classification, description, observation, problem-solving, research, synthesis

Learning Objectives:
Students will be able to:

- Calculate area
- Define biodiversity and sampling
- State two reasons for the importance of preserving biodiversity
- Explain one way scientists determine biodiversity
- Estimate the biodiversity of the schoolyard

Materials

- Pencils
- Notebooks
- Drawing paper
- Graph paper
- Tape measure
- 2 pairs of chopsticks or tent stakes (for older students)
- String (for older students)
- Handout showing common lawn organisms, p. 45
- Hula hoop (for younger students)

Background

Biological diversity, or biodiversity, is the variety of species found in the world. One way to estimate biodiversity is to count the number of distinct species that can be found within a given area. Biodiversity is an important measure of an ecosystem's health. The more diverse an ecosystem is, the greater the chance that some species will be able to survive a sudden disturbance in the environment. Scientists are concerned about the loss of biodiversity for many reasons, including the fact that there are many undiscovered animals and plants. New medicines may be developed from a rare plant species. There may even be new varieties of food crops for humans. (See Background section, for more about biodiversity.)

The diversity of habitats influences the amount of biodiversity in a given area. Each habitat is home to a characteristic variety of plants and animals.

Define Biological Sampling
Sampling involves carefully measuring a small section of a larger area and then mathematically applying these measurements to the larger area. Although it is not always as accurate as counting all of the organisms in a given area, it saves time and money and provides a strong estimate of the larger picture. The way in which plant species are distributed over the area (evenly or unevenly) will make a difference in the accuracy of the estimate. In addition, the larger the sampled area is, the more accurate the results.

Scientists measure an area's species richness using quadrats to find out how many species

and how many individuals of each species live there. A quadrat is a known amount of area from 1 square meter to 100 square meters, depending on what's being studied. It's important to know exactly how large the quadrat you will be using is to figure out the biodiversity of an area and be able to compare it to the same size place in a different area. A quadrat can be a square, a rectangle, or even a circle, just as long as the size of its area is known.

Preparation

1. Copy handout of common lawn insects and other organisms for students. Create or locate a guide to common native plants.

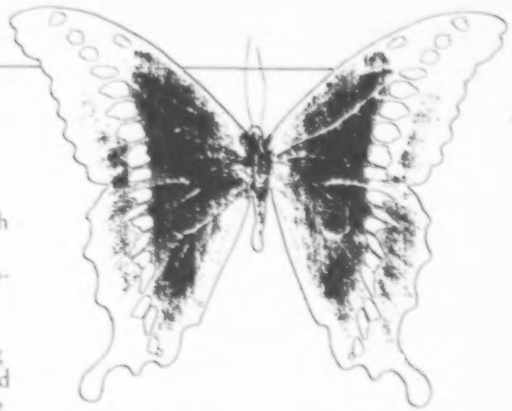
2. Locate a section of the schoolyard (or a nearby park or natural area) that class will investigate for biodiversity.

Procedure

1. Introduce concepts of biodiversity and sampling and discuss the importance of each.

2. One way of sampling plant biodiversity is to count all the plant species in a small patch of

BEST COPY AVAILABLE

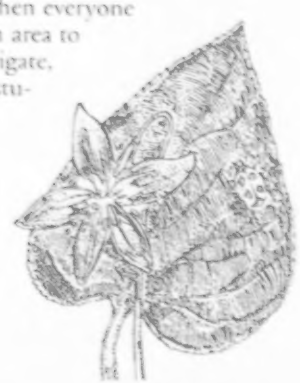


land and then estimate the number in a similar larger area. Scientists use a quadrat, a device that clearly marks the edges of the area of study and tells you the area of land you're focusing on. Discuss what size quadrats students will use (suggest between 1 foot square and 3 feet square). Cut string to the size of the quadrat's perimeter (for a 1-ft square quadrat the perimeter is 4 feet). Add about 10 inches to the string for tying and wrapping around stakes. Alternatively, use a hula hoop to define an area.

3. Tell students that during this activity, they will record all the different kinds of plants and animals they see within the quadrat on graph paper. They should focus on the number of different species, not the total number of organisms. They should draw the quadrat map's borders before going outside.

4. Go to the outdoor area. Have each student throw a ball to pick a random area for sampling study. After each student throws, have them place their quadrat supplies in the area and return to the group for the next throw. Alternatively, you may want to assign different areas of the schoolyard to different groups.

5. When everyone has an area to investigate, have students measure the length of each side of the quadrat with tape measures and place stakes/ chopsticks in each corner. You may want to check these measurements. Tie one end of the string to one stake. Wrap string around all four stakes, pulling the string tight to tie it off.



6. Students should focus first on the plants they see within the quadrat. The grass that makes up the lawn is an obvious one. ***Do they notice any other plants like dandelions or crabgrass?*** Draw these on the graph paper map and list them in a journal. If students don't know the name, have them draw a more detailed picture and look it up in a field guide to plants later.

7. Next turn to insects, spiders and other animals. Students should look at the base of the grass to find insects. Since most of the creatures are very small, they will need to look very closely. Use magnifying lenses if possible. Have them try to count the number of different types in their quadrat. Have them write down all the insects they find and sketch any unknown ones. Help students identify insects using a field guide or handout later.

8. As a group, have students measure the length of the sides of the larger site under investigation. Calculate the area (in square feet) of the site by multiplying the average of the length and the average of the width. ***How many of the quadrats would fit into this larger area?*** Divide site area by the area of a single quadrat to find the quotient. To determine an estimate of the biodiversity of the entire site, multiply the number of all species found in a single quadrat and the number of quadrats that would fit into the entire site. Express the biodiversity in number of species per total site area.

8. Compare each student's or group's biodiversity estimates. ***Were everyone's estimates the same? Why or why not? Was there a problem with the sampling technique? With the uneven distribution of the organisms? Did students with quadrats in different areas of the schoolyard get different results? Why or why not? What are benefits of using this method? What are drawbacks?*** Ask if students have any ideas on how to make the sampling technique more accurate.

Modifications for Younger students

✔ Take the students outside with a hula hoop, have them identify a spot to sample, and conduct the investigation as one large group, asking the students to select plants and animals they see and draw them if possible. When you return to the classroom, count them up together and help the students understand that this is just a sample of the entire area.

Assessment

✔ Set up a similar quadrat in a different local habitat. ***Which habitat has the highest biodiversity?*** Have students propose reasons why or why not.

Common Lawn Organisms

Butterfly

Caterpillar

Ladybug

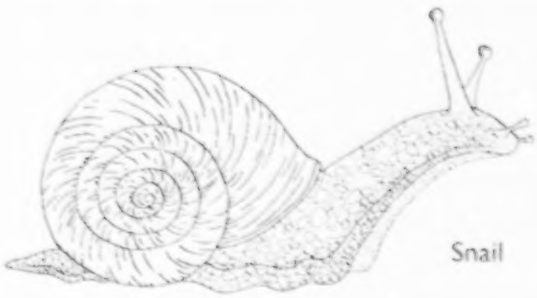
Ant

Frog

Cicada

Cricket

Millipede



Snail

Praying Mantis

Illustrations Copyright Jennifer O'Rourke Lubinsky 2001

© Copyright 2001 National Wildlife Federation

ACTIVITY 4

The Pollinators' Journey

Summary

Students perform a short play about threatened migratory pollinators.

Grade Level: K-4, 5-8

Time: 2 to 3 class periods (90 minutes or more)

Subjects: Science, Language Arts, Art, Social Studies

Skills: Evaluation, observation

Learning Objectives:
Students will be able to:

- List four animals that pollinate flowers
- Describe the the relationship between pollinators and the plants they pollinate
- Name three environmental threats facing pollinators today
- State one way that people can help protect pollinators

Materials:
- Video: Pollinators in Peril (Produced by NWF, to order a loaner copy, call 703-438-6001)
- Flower anatomy reference sheet, p. 48
- Pollinator's Journey work sheets, pp. 51-53
- Paper
- Pencils
- Pipe Cleaners
- Paper plates
- String
- Glue
- Markers or crayons
- A fresh flower
- Pictures of a monarch butterfly, lesser long-nosed bat, organ pipe cactus and milkweed
- Maps of Southern Arizona, the Sonoran Desert and Mexico
- Books on pollination, flowers, monarch butterflies and nectar-feeding bats

Background

Flowering plants are much more common than non-flowering plants. Many people believe that the success of flowering plants is due in large part to the flower's close relationship with animals in the process called pollination.

Many flowering plants depend on animals to reproduce. Bees, butterflies, hummingbirds, bats, ants, moths, beetles and others visit flowers in search of food. In the process, animals pollinate the flowers, bringing their reproductive cells from one plant to another of the same species. Pollination leads to fertilization, the development of new seeds and, in some plants, fruit. The young seeds (either in fruit or not) may be carried by wind, water or animals to new locations where, if all goes well, they will grow into new plants.

How does the process of pollination work? Flowers contain a plant's reproductive parts, including the male anther and the female pistil. (See page 48 for a diagram). The structure of the flower forces the male anther, holding pollen grains, to brush up against the pollinating species while it is looking for its food, the nectar. The female pistil includes the stamen, which is sticky and collects pollen from the bodies of animal visitors, and the egg, called an ova. When pollen grains fertilize an ova, a new seed begins to develop.

Plants, rooted in one place, must face the challenge of transferring pollen to another flower of the same species. Some flowers rely on wind to carry pollen grains, while others use water. Animal pollinators, however, give plants an advantage as they deliver pollen directly to the flower. While collecting nectar from the base of a flower, pollinators like bees brush against pollen from the flower's anther. The bee ends up carrying a load of pollen on its body. At the next flower the bee visits, some of that pollen reaches the female reproductive parts while the bee feeds. For other animals, the exact way they collect and deliver the pollen is different (hummingbirds sometimes collect pollen on their heads!), but the function is the same. The pollination relationship is mutually beneficial to flower and animal – one gets food while the other receives help reproducing.

Over time, flowers have developed adaptations to ensure that the best pollinator for their species will visit and return often to feed. In fact, flowers' fragrance, bright colors, nourishing nectar and varied shapes are considered adaptations to attract certain pollinators. For example, the bright colors of flower petals are thought to help flowers stand out against a green background. Many flowers, such as a black-eyed susan, have a bull's-eye pattern of color to focus animal attention on the part of the flower with pollen and nectar. Violets have both a weak bull's-eye pattern as well as "nectar guides" – a pattern that radiates out from the nectar cup and leads animals to the part

BEST COPY AVAILABLE

of the flower where the nectar, anther and stamen are found. Many flowers have nectar guides, which aren't always visible to the human eye.

Birds and bees find different flowers attractive, largely due to differences in the animal senses. Birds have a poor sense of smell, but keen color vision. Bees use both color and odors to find a suitable flower. The shape of the flower also plays a role in determining the kind of pollinator who can feed from the flower. Butterflies must have a perch to land on while feeding. Hummingbirds can hover in front of the flower and so don't need a place to land. Pollinators have also adapted to ensure that they will have access to flower nectar. Animal adaptations include sense of smell, color preferences, beak shape (especially noticeable in hummingbirds) and tongue length.

Pollinators have a critical role in both agricultural and natural ecosystems. Crop plants depend on pollination to produce much of the food we eat – from wheat and oats to corn and tomatoes. In fact, scientists estimate that every third bite of food humans eat is made possible by the act of pollination. Pollinators are also key to maintaining the health and biodiversity of wildlife habitat. Many flowering plants will not produce seeds for the next generation, such as new oak trees or milkweed plants, without the aid of animal pollinators. A habitat that doesn't have young to replace the old of all species will eventually become less diverse – a few types of plants may become dominant, and in turn, the habitat will be able to support fewer animal species.

In this decade, conservation biologists discovered a disturbing trend. Pollinator populations have declined drastically. Domesticated honeybee populations dropped 25% between 1990 and 1998, mostly due to the spread of a parasitic mite. Wild bee populations face risks from pesticides and habitat loss, and other pollinators, such as birds, bats and butterflies, have also suffered declines. Migratory pollinators appear especially vulnerable to habitat loss and other threats. In the United States many migratory pollinators are in peril. For example, the lesser long-nosed bat pollinates cacti such as the organ pipe and saguaro common to the Sonoran desert landscape. The bat, along with migratory pollinators such as the rufous hummingbird, white-winged doves and monarch butterflies, must move from bloom to bloom to take in enough energy on its 2,000 mile or more journey to Mexico to survive. Along this nectar corridor, human development, extensive planting of non-native species (that pollinators can't feed on) and the destruction of "stop-over" areas by pesticides and human alterations work together to reduce the number of these migrants. For instance, monarch butterflies depend on the milkweed plant for food and a place to raise young. The milkweed is often a target of large-scale herbicide spraying along roads and on farms.

Preparation

1. Write the characters for the play – long-nose bats, monarch butterflies, organ pipe cacti, milkweed plants and humans – on paper scraps. Student groups will pick a character out of a bowl for the play.

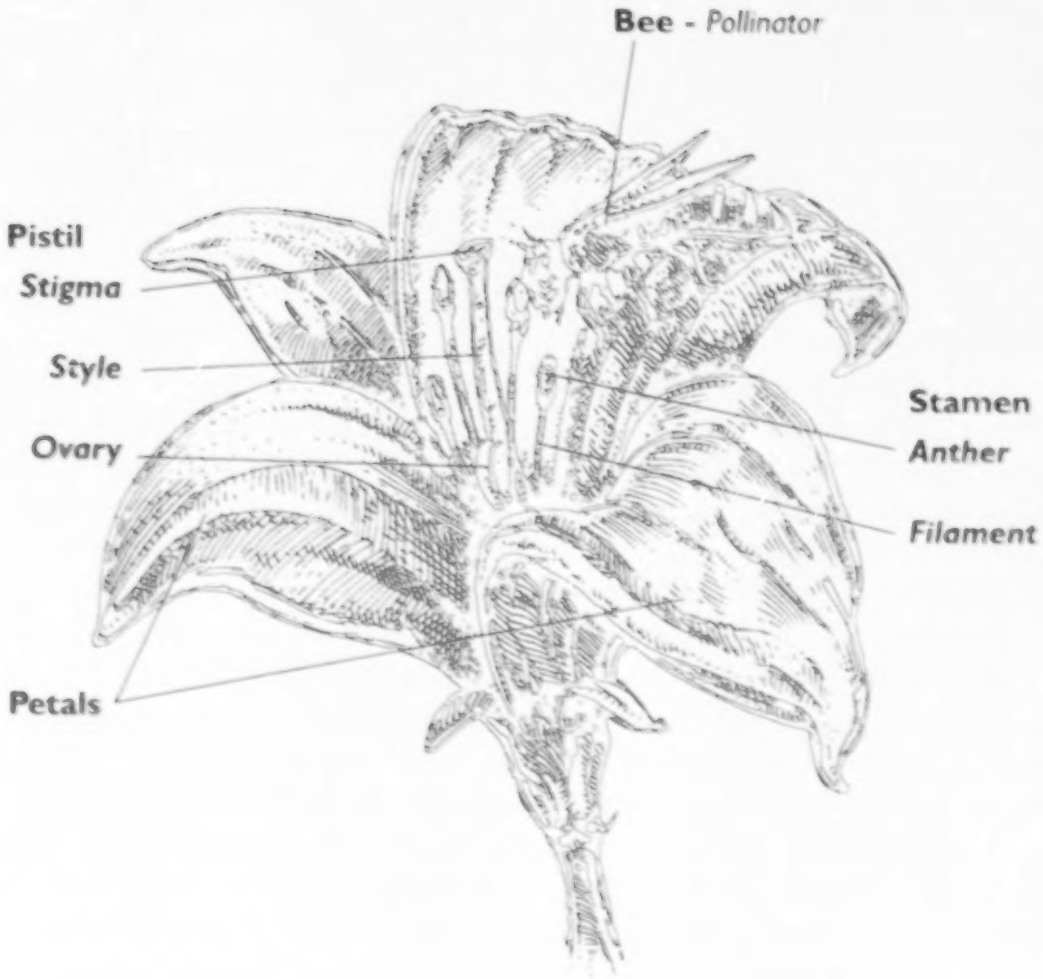
Procedure

1. Introduce the main ideas of pollination – flowering plants and their pollinators have adapted to each other to the point that one may have trouble surviving without the other. Show a diagram of a flower's parts and pictures of different pollinators interacting with flowers. Ask students to give examples of pollinators, such as bees, butterflies, birds, bats and others. Outline the role that pollinators play in maintaining the health of an ecosystem and its biodiversity.

2. Explain that some key pollinators (from honeybees to hummingbirds) are now threatened due to parasites, habitat

ACTIVITY

WORKSHEET



The **Stamen** *is the male part of the flower that produce the pollen.*
Each stamen has 2 parts:
The **Anther**, *which produces the pollen, and*
the **Filament**, *which provides support for the anther.*

The **Pistil** *is the female part of the flower that produces the seeds.*
The pistil has 3 parts:
The sticky **Stigma** *receives pollen during pollination,*
the **Ovary** *produces seeds,*
and the **Style** *connects the stigman to the ovary.*

Petals *surround and protect these parts of the flower.*

© Copyright 2001 National Wildlife Federation

loss, pesticides and introduced species. The effects of a major loss of pollinators could be dramatic. Ecosystems could change their character, as trees and plants once common, begin to disappear. Agriculture could also suffer huge losses, which might lead to less food being produced. Create a chart showing what students know and what they want to know about pollination.

3. If you have it available, watch the NWF video *Pollinators in Peril* for further background for the students. After the video, further complete the chart to survey what students learned from the video.

4. After the video, ask students for ideas on how people can help pollinators. One idea is to plant native plants in the area to help local and migrant pollinators survive.

5. Today students will focus on pollinators that migrate between the U.S. Sonoran Desert and tropical Mexico. Scientists are especially concerned about migratory pollinators, such as the ones in the Sonoran Desert. Use a map to point out the Sonoran Desert as well as Mexico.

These pollinators get food along their journey from flowers along what's called a "nectar corridor." Along the nectar corridor, the pollinators move north or south from one area to the next at the same time that flowers on which they feed are blooming. That means they always have something to eat on their long journey. However, these corridors are suffering. Introduced (non-native) plants are outcompeting some of the plants the pollinators rely on for food. Much of the land along the corridor has been built on or converted to roads or farms. People have used pesticides in some areas that kill the plants relied upon by migrants. Not having enough plants to feed on during the journey reduces the number of pollinators that can survive.

6. Tell students that they will now act out a short play about the problems faced by a special group of pollinators, the migratory pollinators in the Southwestern United States. Divide class into 5 groups, which will each pick one character from a bowl. All of the group members will act as the character during the play. Characters will include two pollinators (the long-nose bats and monarch butterflies), two flowering plants (the organ pipe cacti that bats feed on and the milkweed plants visited by butterflies) and humans. (The human role could also be played by the teacher.)

7. Optional: If there's time, provide art supplies for students to create paper-plate masks to wear during the play. Butterfly masks should include a curled, long proboscis (use pipe cleaners) and antenna. Students may also wish to make wings. Long-nosed bat masks should include a long nose and a long tongue (use pink construction paper) and may also fashion wings. Cacti can color their masks green and cut pipe cleaners in to 1/2 to 1 inch pieces to represent cactus spines. Have them glue the "spines" onto the paper plate as well as a "flower". Milkweed plants may want to draw or cut and paste green leaves and milkweed flowers onto the mask.

8. Read the following story to students once out loud. Then, have them rehearse the four scenes while you remind them of the story, with the educator giving stage directions. Encourage students to expand on the story during rehearsal if they wish.

Modifications for Older Students

1. Follow procedure outlined above through #5. Tell students that they will now work in groups to write scenes about the threats facing migratory pollinators today.

2. Then, hand out copies of the Pollinator's Journey story above. Instead of acting out this story, however, the older students will write their own play based on this story. (Alternatively, have the class pick one example they learned about in the video and set up their own story plot, divided into scenes (keep it to 5 or fewer scenes.) Divide the class into 5 groups. Each group will be responsible for writing

will be responsible for writing one of the scenes outlined in the story. (If students write a new story, divide the class into as many groups as there are scenes, or assign more than one scene to groups.) They should add dialogue, name characters and make

other changes as necessary. If they have additional questions they should do research to find the answers. Students should agree on how they will work together to write the scene. One idea is to improvise within the group, and have one member responsible for recording what is said. Then, the recorder can write the scene based on that. The group and the educator should review and suggest changes on the script before it's shared with the rest of the class.

3. Once all the groups are finished, each group will perform the scene they wrote for the rest of the class. (If they need more actors for the scene, they will need to ask for help from the other groups.) Have them accept comments from others and ask how well all the scenes flowed together. Making some small changes in the scripts may help the scenes work together better. Ask students if they want the same actors to play the parts all through the play, or if each group will perform its scene. They should also consider whether they want costumes, props or a simple set, and how they would go about creating these.

4. Have students perform the final version of the play. Consider inviting a class of younger students (or parents and family members) to come watch the final performance. The student performers may want to have a question and answer session with the younger students about pollination, flowers and the threats facing pollinators today. (This can serve as a built-in assessment.)

Extensions

✔ The loss of domesticated honeybees would heavily impact humans. Research honeybee pollination of crops. ***Which crops rely on bee pollination? How many bees have been lost in recent years? Why? What are farmers doing in response?*** There is more information on this in NWF's Pollinators in Peril video. To order, see p. 46.

✔ Go out to your schoolyard and look for pollinators during different seasons of the year. ***What pollinators can the students find? What can they do to support them?*** Have them investigate the habitat requirements of these local pollinators and plant species that they need to survive.

✔ Have students investigate the travels of hummingbirds and monarchs by observing and sharing data online. Visit Journey North (www.learner.org/jnorth/) for more information.

Assessment

✔ Have students draw a short cartoon (using words and pictures) to illustrate the story of the play. Students should include at least three of the human threats facing pollinators today, how human activities harm the pollinators, the consequences of losing pollinators and a way that people can help pollinators. For older students, read the written version of play.

✔ Research local pollinators, their habitat requirements, and threats that face them. Create a bulletin board with the facts students have discovered about the threats facing pollinators today. See if the class can post it in an area of the school where many students can see it.

The Pollinators' Journey

Narrator

It is early fall in the beautiful Sonoran Desert of Arizona. Long-nosed bats and monarch butterflies live here in the summer. Soon, they must start a long journey south where they live in the winter. The nights are starting to get cooler. The flowers that bats and butterflies feed on have begun to fade. It is time to begin their journey to Mexico.

Stage Directions

Bats pretend to fly while feeding on cacti. Butterflies will fly and land next to milkweed flowers to feed. When students hear the word "cooler" they should begin to shiver (although these animals do not shiver in reality, this is a good tool for conveying the idea of the changing season). As the bats and butterflies try to continue to feed, the cacti and milkweed flowers sit down and drop their heads. The butterflies and the bats all know it is time to begin the journey. They leave the scene. Suggestion: There is no role for humans in this scene. Perhaps have that group be wind or act as flowers just for this scene.

Narrator

Each year the pollinators follow the same route to Mexico, called a nectar corridor. They stop at the same places each year to rest and feed on flowers. But this year, one of the rest stops is missing! A new golf course stands where there were once hundreds of flowers to feed on and cover to hide in. A few flowers remain, but many of the pollinators have nothing to eat. Without food, some pollinators get very tired. They don't have the energy for the long trip. Some bats and butterflies die. Others move on.

Stage Directions

Have bats and butterflies start on one side of the room and move together across the room. The flowers stand facing each other, forming a corridor for the group of pollinators to move through (as the pollinators pass, the flowers should move to the front of the corridor line. The Humans group should form a football huddle to represent the new golf course, right in the nectar corridor. Flowers nearby have died during the construction and sit on the floor with their heads dropped. One cacti and one milkweed will remain standing. Bats and butterflies feed on the flower, but all of the pollinators are tired and moving slowly. One out of three of the pollinators should lay down on the floor to show they have died (they should act as humans in next scene). The other pollinators leave to continue the journey.

© Copyright 2001 National Wildlife Federation

The Pollinators' Journey *continued*

Narrator

Arriving at their winter home, there are fewer bats and butterflies than usual. New buildings and highways have destroyed some of the usual rest stops along their journey. Herbicides sprayed along highways may poison butterflies. Breaking up habitat into smaller areas makes the journey harder, as cities, houses and highways fragment wild habitat into smaller pieces. But those that have made it can live in peace for awhile.

Stage Directions

The remaining bats and butterflies arrive at their winter home, where the flowers are all in bloom. As the teacher talks about the threats facing pollinators, the humans should act out the actions of: building, spraying herbicides and cutting down trees and shoveling over wild habitat.

Narrator

In spring, the weather warms. It's time for pollinators to begin their return journey to Arizona. The flowers have started to fade. The bats and butterflies depart.

Stage Directions

Bats and butterflies are feeding on flowers. Slowly, flowers begin to sit down and drop their heads to show they are not in bloom anymore. The bats and butterflies may use human cues to show they are getting hotter, such as wiping sweat from the brow or fanning themselves (like shivering, this is a human way to deal with heat, but will help get the ideas across). Humans sit out during this short scene.

© Copyright 2001 National Wildlife Federation

The Pollinators' Journey *continued*

Narrator

Near the end of the journey, the bees and bats are very tired. While some stop-over spots are still rich with nectar, others have been destroyed. If only there were a flower-filled field over the next hill. Suddenly, they see flowers in bloom. It's a rest stop lost years ago to development and it looks inviting again. The flowers sit in a garden next to a large school building. Students have been working hard to create wildlife habitat on their schoolgrounds. They've selected the exact plants that they know these migrating pollinators are looking for, and they have added bat boxes to their habitat. Hungry, the pollinators fly down to the garden to feed on flowers. In the garden, they see children weeding around the cacti and milkweed and watering young plant seedlings. The pollinators all get enough to eat. They are ready for the final miles of their trip, well-fed and prepared to go on. Flapping their wings, the bats and butterflies fly away, leaving the children quiet with awe and happy that they have helped to make the pollinators journey a successful one.

Stage Directions

Humans and flowers should all be on one side of the classroom. Flowers are in bloom, while humans are tending to the Schoolyard Habitat. The bats and butterflies are flying, obviously tired and slow, toward the garden. They swoop down to the flowers and feed on the nectar. Once they have all had a chance to feed, they move much more quickly, and fly away with much more energy. The humans stare at them in awe and smile while the bats and butterflies leave the room/area.

© Copyright 2001 National Wildlife Federation

ACTIVITY 15

What To Do With an Empty Lot

Summary

Students take part in a role-play activity based on a real conflict over land use.

Grade Level: 3-4; 5-8

Time: 2 class periods (45-90 minutes)

Subjects: Science, Social Studies, Economics, Drama

Skills: Analysis, application, description, evaluation, problem-solving, synthesis

Learning Objectives:
Students will be able to:

- Recognize the complexity of deciding how to use land
- Name the main stakeholders in decisions about land use
- List three different ways that land may be used

Materials:
- Paper
- Pencils
- Copies of map and role-play cards

Background

As more wildlife habitat in cities, towns and rural areas has become threatened by development, it has become increasingly clear just how limited a resource land is. Scientists blame many of the huge declines in wildlife that lead to endangerment and extinction on the huge losses of habitat in North America. Although scientists think extinction of living things is part of a normal process, some estimates put the current rate of extinction at least 1,000 times greater than the usual rate would be without human activities (determined from fossil records). Already, 90 percent of the Midwest's tall-grass prairie system has been lost; over 90 percent of the Pacific Northwest's ancient forests have been harvested; and over 50 percent of U.S. wetlands have been destroyed. Making wise decisions about our limited land resources is a key part of saving habitat for wild creatures.

There are often conflicts between protecting the needs of wildlife and ensuring that the needs of people are met. As human population continues to grow, as do people's needs for food, clean water and housing (shelter). For example, the burgeoning human population in Florida threatens the habitat of the Key deer, a species listed as endangered since 1967.

Land also has economic value, which often increases when owners develop their land. While development produces profits for owners, it also helps balance the costs of owning land, which includes a variety of taxes and fees.

All of these considerations mean that decisions on how to best use land have become increasingly complex in the last few decades. Today, many people are actively involved in the decision-making process. Along with owners and government agencies, people affected by habitat loss or change often voice their concerns about land use, including neighbors, environmentalists, housing advocates and other activists. Even areas that have been used as military bases, industry or housing for many years face challenges when new developments are proposed. Many citizens and environmental groups try to balance human and wildlife needs, working to minimize new development's impact on wildlife habitat. With thoughtful planning, new development can become an opportunity to reclaim and restore wildlife habitat.

In the City of Los Angeles, one such development, called Playa Vista, has been a source of contention for nearly two decades. In this activity, students will role-play stakeholders in a simplified and adapted version of the real conflict over the Playa Vista project.

BEST COPY AVAILABLE

Preparation

1. Copy one of the following per group: maps, background information and role-play cards.

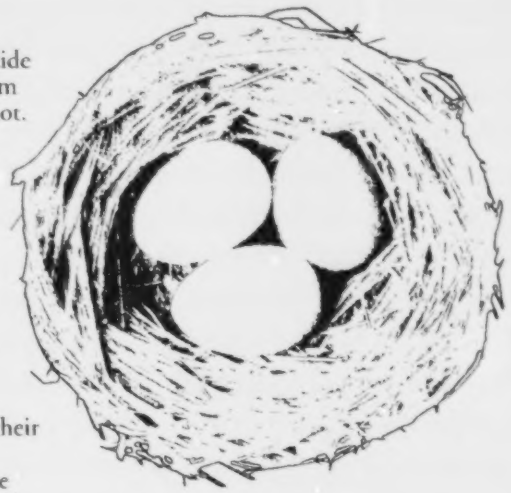
Procedure

1. Ask, ***What would you do if you had a piece of land and all your friends wanted to do something different with it?*** Explain the activity to participants, and give out the worksheets. Emphasize that participants will be taking on the roles of various groups involved in deciding what to do with a vacant lot. The first handout is a map of an open space in town; the space is about the size of one football field, and has a natural stream running along one edge of it. The owner of the lot has been approached by different groups, which have expressed interest in using the land.

2. Using the role-play handouts provided, assign roles to participants, being sure to divide them into diverse groups with varied interests. If possible, assign a volunteer to help guide each group.

3. Give each group the appropriate handout and 15 minutes to meet, read, discuss their positions, and create a strategy for convincing the owner their position is the best option. Have them write the points they will make on the handouts so that they have a written strategy to present to the class.

4. At some point while small groups are discussing options, inform the Conglomerate group that their company has been cited for illegally dumping chemical waste in the past. None of the other groups know this. Tell the group they can decide whether they want to inform the Owners about this or not. If they do not make the announcement themselves, inform them that at some point, you (the teacher) will act as "whistle blower" and inform the Owners of this fact.



5. While the rest of the groups are developing their strategies, have the Owners group complete the math questions. They should also develop the criteria they will use for making their decision, before they hear the other groups' arguments. Tell them that they must pay attention to all the arguments, avoid making judgements before they have heard all groups, and that they must vote at the end of the period on the plan they will accept for their land. They will be able to choose only one of the options presented.

6. When all groups are ready, have them take turns presenting their case to the owners. At the start of each presentation, have the group write its name on the blackboard. Give each group five minutes to present its argument.

7. After all the presentations have been made, allow the Owners 10-15 minutes to reach a decision. During this time, have each participant from the other groups write down what he or she thinks will be done with the land, why, and whether this differs from the views of the group he or she was in.

8. When the Owners have reached their decision, they should and tell the group what they decided to do and why.

9. Lead a discussion about the way the participants felt when they presented their cases, and the way they felt when their proposals were or were not selected. Discuss how one decision can affect the environment, the people, and the economy and financial interests of many people at the same time. ***Are there any land use issues currently in the news in your neighborhood? What are they? What opinions do your own students have about these issues?***

Modifications for Younger Students:

1. Introduce the activity with a story. Show them the map of the empty lot and explain that it is about the size of a football field and has a natural stream running along one edge. Tell them that different groups would like to use the land for different things.

2. Break the students into the different groups. Use less complex and detailed group names, such as The Owners, The Gardeners, The Animals (replaces

environmentalists), The Park, The Office Building, and the Shopping Mall. Give each group a copy of the map or post it in a place everyone can see.

3. Tell each group they are going to draw or create a model of what they want to do with the lot. Make sure all the groups (except the Owners) understand that they are pretending to be whatever their name is. For example, if they are the Shopping Mall, they need to draw or build a shopping mall. They also need to either include the features on the original map, like the stream, or explain what they did with them.

4. Have the Owners also draw what they want to happen in their space. They can choose from the other group ideas or come up with their own. They must also include the features of the map. Have each group (except the Owners) show their artwork and explain different pieces. Have the Owners show their piece, then tell them which one of the others they would choose. ***Why? Was it different than what they drew?***

5. After all groups have had a turn to explain their artwork, lead a discussion about how the groups felt when their drawing was or was not selected.

Modifications for older students

Have students research a local issue and create their own role playing game. Bring in some current newspapers and magazines for ideas. The group should decide as a whole what issue they want to address and then divide up in groups to write the descriptions for the individual interest groups involved. Then have the group present their game to another group and lead it. ***What do they discover?***

Extensions

✔ Have students research a dispute over land use in your area. ***Are there any "empty lots" near your schoolyard? What should be done with them? Why?***

✔ Invite representatives from a local environmental organization, city or regional planners, developers or the local government to your school to discuss the issues of development and habitat preservation. ***How are land-use decisions made in your community?***

✔ ***What benefits do open space and wildlife habitats provide for people?*** Have students explore the many answers to this question. One unexpected benefit is profits. With habitat, especially the wetland habitats that so many birds depend on, disappearing so rapidly, wild lands rich with plants and animals increasingly attract "wildlife watcher" tourists (and their dollars) to out of the way places. Habitat conservation and restoration don't always mean a loss of income for the community. For example, over 2 million wildlife watchers come to the state of Virginia each year, spending some $700 million annually. City officials in the small town of Baytown, Texas were surprised by the nearly $1 million increase in local revenues produced by converting a sinking subdivision into a restored wetland adjacent to the Great Texas Coastal Birding Trail.

✔ Visit an area that is in the process or was converted from human use back to wildlife habitat. ***How was the land used by humans? Is the habitat fully restored? What more has to be done? Is it easier to preserve intact wildlife habitat or to restore damaged habitat? Have local businesses profited from the restoration of open space for wildlife? How has the local community benefited?***

Assessment

✔ Have students write a newspaper article about what happened in their debate, why the outcome came out the way it did, and the impact of each possible decision.

✔ Have students think about they do with their schoolyard. ***Who are the stakeholders (i.e., students, teachers, sports teams, wildlife, maintenance workers, community members, etc.)?*** Have students write a brief paragraph on what each of their identified groups may want to propose for the schoolyard. Representing these different groups (including themselves), they could include proposals, maps, and any pertinent information. Later, you may want to have students share these proposals with the actual groups in deciding how to plan your schoolyard habitat.

OWNERS *Role Play Sheet*

You are the owners of an empty lot in the center of town. Many different groups wish to use your property for their own purposes. You must make a decision about what you will do with your property. As owners, you pay property taxes of $250.00 per year. You have owned the property for ten years. You bought the land from the town for $5,000 ten years ago. The value of the lot today is $10,000.

Write the total amount you have paid for this lot on the line below:

$250.00 per year X 10 years _____

Original purchase price _____

TOTAL expenditure for lot _____

Current value of the lot _____

You have asked all the groups interested in your land to attend a meeting to explain why each want to use your land. Your group must then make a decision about what to do with the land.

© Copyright 2001 National Wildlife Federation

GARDENERS' GROUP *Role Play Sheet*

You are members of the local gardening group who want to use the land to grow fresh vegetables. The money you earn will start a Student Gardening Corps, where participants learn gardening skills and help run the garden. You also want to give vegetables to the soup kitchen to feed homeless people. You are a non-profit organization, but you are willing to pay the owners $250.00 per year to rent the land. This happens to be the same amount that the owners pay in property tax.

What is the name of your organization?

_____

List three reasons your group should have the lot.
You will present these reasons to the owners.

1. _____

2. _____

3. _____

How much money are you willing to pay the owners for the lot?

© Copyright 2001 National Wildlife Federation

PARENTS' GROUP *Role Play Sheet*

You think the lot should be made into a park. The native vegetation should be cleared and replaced with grass so children can run freely. Playgrounds and picnic tables will be installed. This park would be closer to many people who have to travel a long way to get to another park. Your group asked the city to purchase the land for the park, and the city has said it would buy back the land for the price it was sold for ten years ago: $5,000.00. However, the land is now worth $10,000.00.

What is the name of your organization?

_____

List three reasons your group should have the lot.
You will present these reasons to the owners.

1. _____

2. _____

3. _____

© Copyright 2001 National Wildlife Federation

ENVIRONMENTALISTS *Role Play Sheet*

Your group believes the lot should be left as open space. The lot has been wild for ten years and is the largest piece of open space in town. It's home to several species of birds, small mammals and insects. The stream has fish, frogs and turtles; the land has some native plants growing on it. Your group does not have any money to buy the lot, nor do you want to own it.

What is the name of your organization?

_____

List three reasons your group should have the lot.
You will present these reasons to the owners.

1. _____

2. _____

3. _____

What will you pay the owners for the lot? What can you propose in terms of management, if you don't want to own the lot yourselves?

_____

_____

_____

_____

_____

© Copyright 2001 National Wildlife Federation

CONGLOMERATE *Role Play Sheet*

Your company wants to buy the lot to build a mini-mall that will have a food store, a dry cleaner, a pinball arcade and a photo lab. The mall will create 50 local jobs, so it has an important economic value. Your company has been cited for environmental violations in the past for dumping chemicals into local creeks. You still dump chemicals secretly and pay the fines when you are caught. Your company has a lot of money, and could make a lot of money on the mall. You offer the owners $20,000.00 for their lot, which is twice the present value of the property.

What is the name of your organization?

_____

List three reasons your group should have the lot.
You will present these reasons to the owners.

1. _____

2. _____

3. _____

How much money are you willing to pay the owners for the lot?

_____

© Copyright 2001 National Wildlife Federation

ACTIVITY 15

WORKSHEET

OFFICE BUILDING DEVELOPERS *Role Play Sheet*

You would like to buy the lot and build an office building for your growing company. The building would provide 100 new jobs, so it has economic value. Your company is willing to pay the Owners the present property value of $10,000.00 for the lot.

What is the name of your organization?

_____

List three reasons your group should have the lot.
You will present these reasons to the owners.

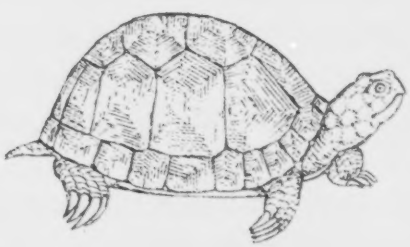
1. _____

2. _____

3. _____

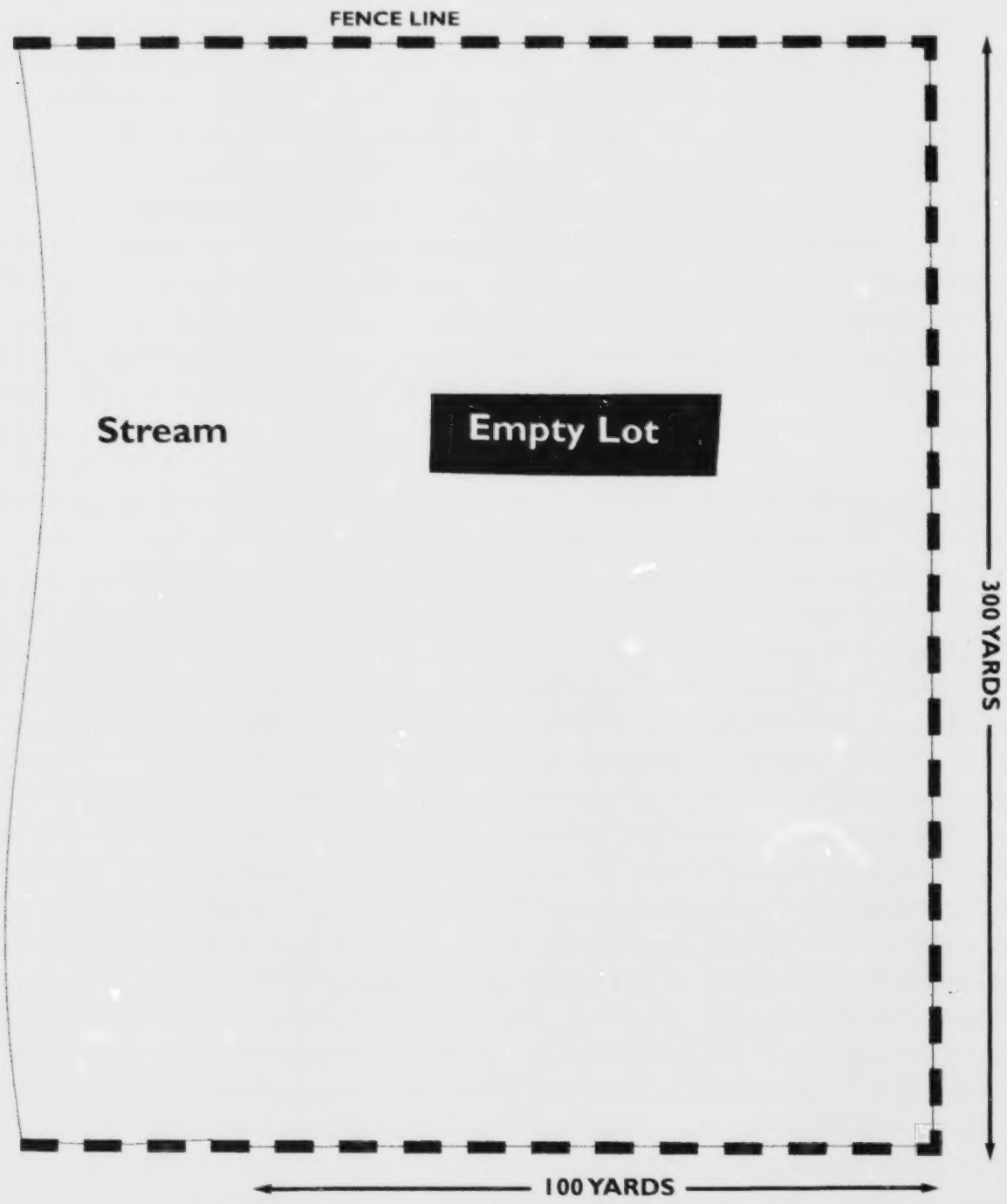
How much money are you willing to pay the owners for the lot?

_____



© Copyright 2001 National Wildlife Federation

MAP OF EMPTY LOT



© Copyright 2001 National Wildlife Federation

Appendix

Alignment with National Science Education Standards

STANDARDS	What's Your Habitat?	Habitat Facts, Habitat Maps	Habitat for Sale	Create a Habitat	Climate Around the World	Watching Plants Grow	Digging Dirt	Slopes and Puddles	Wind Power
	ACTIVITY								
SCIENCE AS INQUIRY									
Science as inquiry	✔	✔		✔	✔	✔	✔	✔	✔
LIFE SCIENCE									
Characteristics of organisms		✔	✔	✔		✔			
Life cycles of organisms			✔	✔					
Organisms and environments	✔	✔	✔	✔		✔			
Structure and function									✔
Reproduction and heredity									✔
Regulation and behavior		✔	✔	✔		✔			
Diversity and adaptations	✔	✔	✔	✔					✔
Populations and ecosystems		✔	✔	✔					
SCIENCE AND TECHNOLOGY									
Technological design				✔	✔			✔	✔
Understanding about science/technology				✔			✔	✔	
SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES									
Populations, resources, environment	✔	✔	✔						
Risks and benefits									
Science/technology in society				✔					
HISTORY AND NATURE OF SCIENCE									
Science as a human endeavor					✔	✔	✔	✔	
Nature of science					✔	✔	✔	✔	
PHYSICAL SCIENCE									
Properties and changes in properties in matter					✔		✔	✔	✔

Alignment with National Science Education Standards

STANDARDS	Food Chain Mania	Bluebird Madness	Fill the Bill	Schoolyard Biodiversity	Pollinator's Journey	What do Do with an Empty Lot
	ACTIVITY					
SCIENCE AS INQUIRY						
Science as inquiry				✓		
LIFE SCIENCE						
Characteristics of organisms	✓		✓	✓	✓	
Life cycles of organisms	✓	✓			✓	
Organisms and environments	✓	✓		✓	✓	
Structure and function			✓		✓	
Reproduction and heredity		✓			✓	
Regulation and behavior	✓	✓				
Diversity and adaptations	✓		✓	✓	✓	
Populations and ecosystems	✓	✓		✓	✓	
SCIENCE AND TECHNOLOGY						
Technological design			✓			✓
Understanding about science/technology						✓
SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES						
Populations, resources, environment	✓	✓		✓	✓	✓
Risks and benefits					✓	✓
Science/technology in society					✓	✓
HISTORY AND NATURE OF SCIENCE						
Science as a human endeavor				✓		
Nature of science				✓		
PHYSICAL SCIENCE						
Properties and changes in properties in matter						

BEST COPY AVAILABLE

Further Resources

Below are several resources for further reading and study for students. Also, see the extensive resources section in the Schoolyard Habitats Planning Guide module of this kit.

Arnosky, Jim, 2000. *Crinkleroot's Guide to Knowing Animal Habitats*

Fife, Dale H., 1991. *The Empty Lot* Sierra Club Books/Little Brown & Co., Boston.

Hare, Tony, 2001. *Animal Habitats: Discovering How Animals Live in the Wild,* Facts on File, Inc., New York.

Hewitt, Sally, 1999. *All Kinds of Habitats*, Children's Press, New York.

Lauber, Patricia, and Holly Keller, 1995. *Who Eats What? Food Chains and Food Webs*, HarperCollins Juvenile, New York.

Lauber, Patricia, 1994 Furs, Feathers, and Flippers: *How Animals Live Where They Do*. Scholastic Trade, New York.

Parker, Nancy. W. and Joan R. Wright, 1990. *Frogs, Toads, Lizards and Salamanders*, Greenwillow Books, New York.

Mazer, Anne, 1991. *The Salamander Room*, Alfred A Knopf, New York.

Relf, Patricia and Nancy W. Stevenson, 1995. *The Magic Schoolbus Hops Home: A Book about Animal Habitats,* Scholastic Trade, New York.

Svedberg, Ulf, 1988. *Nicky the Nature Detective*, R&S Books/Farrar, Straus & Giroux, New York.

Websites

www.nwf.org	information and further resources on habitats
www.enature.com	location and species-specific information on plants and animals
cgee.hamline.edu/frogs	information and activities on frogs
www.ornith.cornell.edu	information on numerous bird-related projects
www.naba.org/4July.html	information on 4th of July bird counts
www.greenmap.com	green areas in urban landscapes
www.audubon.orgbird/index.html	bird information and activities
www.nabluebirdsociety.org	bluebird information
www.learner.org/jnorth	track spring migrations of various animal species

NATIONAL WILDLIFE FEDERATION®
www.nwf.org™

The World of Nature As Your Classroom

Credits
Writers /Editors
Tracie Beasley
Sharon Katz Cooper
David Heath
Stephanie Stowell
Julie Totaro
Craig Tufts

BEST COPY AVAILABLE

Schoolyard Habitats® Site Planning Guide

Contents

National Wildlife Federation

1 ***Introduction***
- Overview . . . 3
- The Schoolyard Habitats Program . . . 4
- Widening the Classroom Walls . . . 5
- The Community Connection . . . 6
- Schoolyard Habitats vs. Traditional Landscaping . . . 7

2 ***Starting the Process***
- Creating the Habitat Team . . . 8
- The Curriculum Committee . . . 10
- Vision and Goals . . . 12

3 ***Gathering Information: Site Inventory and Analysis***
- Site Inventory . . . 14
  - Activity: Habitat Hunt . . . 17
  - Activity: Wildlife Observation . . . 20
  - Activity: Base Mapping and Inventory . . . 24
- Selecting the Site . . . 34
- Analyzing the Site . . . 34

4 ***Assembling the Elements***
- Schoolyard Habitats Design . . . 37
  - Activity: Dream Habitats . . . 39
- Defining your Schoolyard Habitats Project . . . 43
- Selecting the Materials . . . 43
  - Activity: Habitat Plant Selection . . . 44
  - Plant Selection Chart . . . 46
  - Planning . . . 47
  - Budget Planning Guide . . . 48
  - Activity: Breaking New Ground . . . 49
  - Activity: Planting Your Wildlife Habitat Site . . . 52

5 ***Ensuring Continued Success***
- Maintenance . . . 55
  - Activity: Creating a Field and Care Guide . . . 56
- Integrating Habitats site into Cross-Curricular Learning . . . 58
- Schoolyard Habitats Certification Process . . . 61
- Schoolyard Habitats Application Form . . . 62

6 ***Schoolyard Habitats Resources Guide***
- Printed and Online Materials . . . 66

7 ***Appendices***
- Appendix 1: Accessibility Guidelines for Schoolyard Habitats . . . 88
- Appendix 2: Using a Compass . . . 91
- Appendix 3: Container and Rooftop Gardening . . . 92

Feedback Form . . . 94

117

Overview

The National Wildlife Federation® (NWF)'s Schoolyard Habitats® Program, assists schools, teachers, students and community members in the creation and restoration of wildlife habitat and in the use of school grounds as learning sites for wildlife conservation and interdisciplinary learning.

Why should we make this effort to provide homes for songbirds, butterflies and other wildlife with whom we share our communities? Habitat loss is the greatest threat to biodiversity – the grand variety of life forms on Earth. No matter where we are, we can take small actions in our daily lives to make a positive impact on our local environment. At our schools, community centers and learning centers, we have the opportunity, and perhaps an obligation, to put our youth in contact with the natural world. The Schoolyard Habitats Program offers this opportunity while enhancing the quality of education in our schools and communities.

In this guide, students apply their knowledge to the design, creation and development of a wildlife habitat site on their schoolyard or other community space. In the following pages, educators will find information, activities and resources for establishing a habitat-based learning site, including the steps involved in planning, designing and establishing a wildlife habitat project and outdoor classroom.

The Schoolyard Habitats® Program

Habitat Loss in the United States:

- Since the late 18th century, over half of the wetlands in the lower 48 states have been filled in, drained, or otherwise lost.
- California alone has lost 91% of its wetlands.
- Ninety-five percent of old-growth forests – which tend to support the greatest biological diversity among forests – have disappeared.
- Waving grasslands up to eight feet in height once covered Iowa, most of Illinois, and a broad band through Texas. Today less than 1% of this native tallgrass prairie remains.

BEST COPY AVAILABLE

The Schoolyard Habitats® Program

Schoolyard Habitats sites meet the needs of wildlife by providing the four critical habitat components: food, water, cover, and places to raise young. These projects offer many benefits to students and educators including: enhanced hands-on learning opportunities, on-site "field trips," decreased grounds maintenance costs, development of stronger ties within the community and a sense of empowerment and environmental stewardship in students both in their own neighborhoods and beyond. Schoolyard Habitats sites offer unlimited opportunities for active cross-curricular learning and provide a creative tool with which educators can meet state and national standards of learning.

The size and scale of Schoolyard Habitats projects vary greatly. Some schools turn a small corner of asphalt playground into a wildlife haven with raised bed gardens and bird feeders. Others transform the entire school grounds into a home for native plants and local and migratory wildlife.

As the public becomes increasingly aware of the importance of conserving habitat to protect wildlife, and as educators seek to provide hands-on learning opportunities for their students, interest in creating habitat sites has increased. Thousands of school communities have made use of Schoolyard Habitats Program materials, participated in our professional development workshops, and initiated Schoolyard Habitats projects with NWF support. As part of the program, NWF recognizes the ongoing efforts of schools – in urban, suburban and rural areas – through a national certification process.

For the students involved, creating and maintaining a habitat project provides a dynamic, relevant, real-world learning experience. Creating or restoring a habitat not only gives students a hands-on opportunity to learn about wildlife, but also empowers them to create positive change and take an active role in their school, neighborhood and community. Working on a Schoolyard Habitats project allows students to discover how they can make a difference. Reinforcing these lessons with awareness activities and continued project upkeep develops students' sense of stewardship for the natural world. This combination of new awareness and involvement in a successful, tangible action project fosters a lifelong interest and involvement in local and global environmental issues.

Widening the Classroom Walls

The traditional indoor classroom works well for many students and many types of lessons. However, for learning about the natural world, providing a dynamic context for learning about all subjects, and for meeting the needs of children with different learning styles, the indoor classroom may prove limited. Schoolyard Habitats sites are often thought of as outdoor classrooms: living laboratories where learning can be extended or skills can be applied. An outdoor classroom provides educators and students with the opportunity to draw upon each of their five senses as they explore the world around them. Schoolyard Habitats sites can become a regular destination for on-site field trips for students of all ages and abilities.

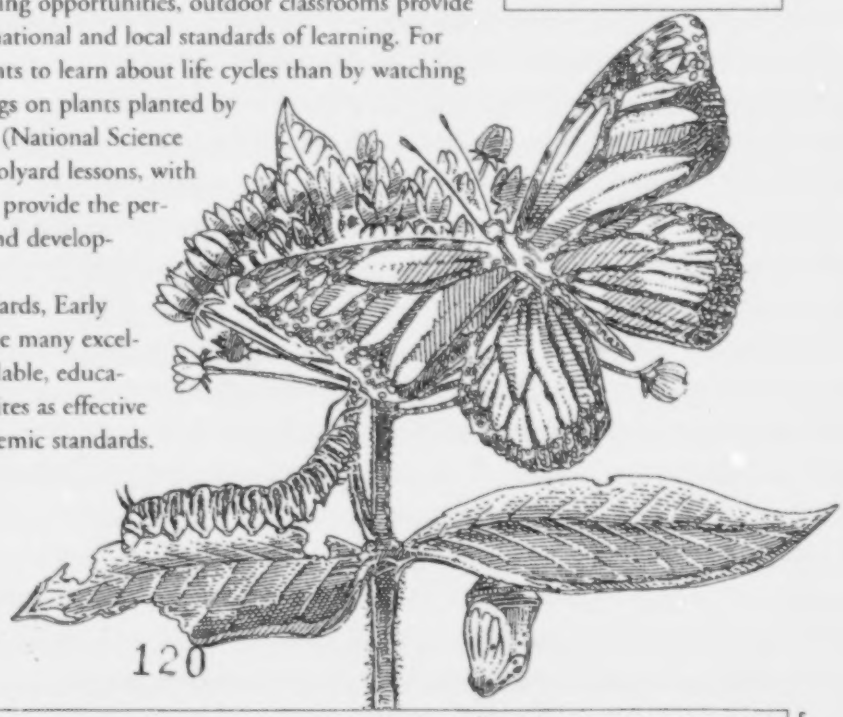
In the outdoor classroom, students find motivation for learning that may be re-visited with new enthusiasm in the traditional classroom. Children's natural curiosity will be sparked by the concrete, personal investigations possible in their own living laboratory. To help make the invaluable opportunities of the outdoor classroom accessible to all students, we have included guidelines for adapting activities and site designs to students with disabilities.

In the past, observing nature and participating in activities in the outdoors were often considered opportunities only for teaching science and natural history. Today, outdoor classrooms are used both as a means to deepen teaching within all subject areas (math, language arts, geography and art, to name a few), as well as a way to provide context for studies across disciplines.

In addition to cross-curricular learning opportunities, outdoor classrooms provide unique and effective ways to meet national and local standards of learning. For example, what better way for students to learn about life cycles than by watching real butterfly larvae emerge from eggs on plants planted by students in their very own meadow (National Science Standards, Life Science, K-4)? Schoolyard lessons, with a focus on local plants and wildlife, provide the perfect backdrop for student writing and development of personal connections to a place(National Social Science Standards, Early Grades). Taking inspiration from the many excellent professional curricula now available, educators embrace Schoolyard Habitats sites as effective tools with which to meet high academic standards.

The Benefits of Field Trips to an On-site Schoolyard Habitats Project

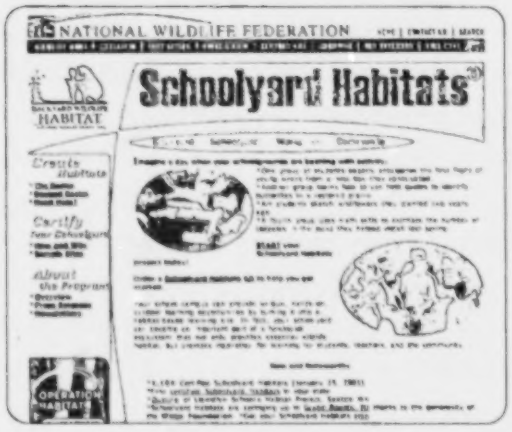
- *Immediate accessibility*
- *Maximized teaching time*
- *Minimized liability concerns*
- *Cost savings*
- *Continuous availability*
- *Reduced need for additional supervision*
- *Abstract lessons come to life*



The Community Connection

The benefits of Schoolyard Habitats projects are many and varied, but to be successful, community involvement and support is essential. Involvement by local resource professionals will add invaluable expertise and creativity to the project. To build greater support for the habitat creation, explain to the school community the ways in which the habitat site will enrich all students' education. Highlight the ways that a Schoolyard Habitats site will benefit the entire community, by creating a neighborhood jewel, a new source of pride and spirit, and potentially, a public place for all to visit and enjoy nature's wonders.

NWF provides educators with access to many resources that will aid in gathering community support. NWF's inspirational Schoolyard Habitats video can be used to attract attention and support of parents and community members. Our on-line, state-by-state listing of certified schools can help connects interested educators with nearby schools that have already successfully certified a Schoolyard Habitats site. Inviting a teacher or principal from a school with a thriving Schoolyard Habitats program is a great motivational tool for educators, students and administrators. NWF also offers a range of high quality professional development opportunities. In addition, the Schoolyard Habitats Website www.nwf.org/schoolyardhabitats/ includes articles about how Schoolyard Habitats sites work as powerful teaching and learning tools – for students and the community at large – which can be used to illustrate the potential benefits of the program to administrators and potential donors.



As with many community projects, the more people committed and involved in a Schoolyard Habitats project, the stronger the final product will be. A wide support base is critical to ensuring the continuity of the project over the long-term. Educators will find that the creation of a habitat-based learning site requires a team of people (students, educators, community members) with diverse interests, skills and experience.

Many schools have had great success with involving the local community in their

www.nwf.org/schoolyardhabitats/

BEST COPY AVAILABLE

project. Parents not able to volunteer during school hours enjoy adding their time to a weekend planting day, while businesses enjoy the tangible results of their contributions. A small amount of effort directed toward the conservation of wildlife habitat on school grounds or other community areas produces positive outcomes for wildlife and people. Development of a Schoolyard Habitats project fosters a sense of ecological awareness, stewardship, empowerment and "big picture" thinking among students, teachers, administrators and community participants alike.

Schoolyard Habitats vs. Traditional Landscaping

Traditionally, school landscapes are developed without much thought to regional climate or to native wildlife and plants adapted to that region. Across the country, turf grass and pavement are the most common covers on schoolyards and community use areas. Yet, with careful planning and planting of a Schoolyard Habitats site, urban, suburban and rural schools can create a lower maintenance habitat that invites and supports local wildlife and learning.

Large-scale schoolyard transformations are often achieved through environmentally sound landscaping choices. From a cost-savings standpoint, these choices will result in reduced landscape maintenance and energy expenditures. **Read on to learn how to turn the schoolyard into a habitat for wildlife.**

Environmentally Sound Landscape Choices

- *Grow native plants*
- *Reduce turf areas*
- *Eliminate pesticide use*
- *Reduce fertilizer use*
- *Reduce water consumption*

Assembling the Habitat Team

Creating a habitat site requires the dedication and work of many people. Establishing a team is essential: having a core group of committed leaders will ensure the long-term sustainability and growth of the project. Assembling a Habitat Team is the first step toward getting others involved and committed to the project. The Habitat Team acts as the driving force behind the development and continuity of a Schoolyard Habitats project. The team must lead the planning, fundraising, publicizing, building and planting of the habitat-based learning site. The diverse skills and support each member of the Habitat Team brings to the project will be crucial to the habitat's overall conception, construction and maintenance. For a solid foundation, the Habitat Team should include representatives from each of the following school community groups: students, educators, administrators, maintenance staff, parents, local businesses, resource professionals and curriculum developers. A worksheet follows (page 11), to assist in your planning process.

Students

Student leadership and initiative are essential to a successful habitat project. From the beginning, the components, structure and goals of the Schoolyard Habitats project should be defined by student input and ideas. Students serve as a tremendous source of enthusiasm and creativity for habitat projects. Involving students throughout the process will maximize the educational potential of the project, and help students develop a strong sense of ownership and empowerment.

Educators

There should be at least two educators on the habitat team. Their consistent, direct work with students enables educators to help guide students in the planning and creation of the habitat. Educators should work to strike a balance between pushing the project forward and stepping back to allow student initiative. Throughout this process, educators may serve as mentors and facilitators, providing both inspiration and guidance for students. Educators also play a critical role in gathering support from the school faculty, and helping colleagues seize the educational opportunities presented by the project.

Administration

Support and participation of school officials is crucial. Administrators can offer insight into budget concerns, future building plans, liability issues, community relations and funding opportunities. School officials react favorably to projects such as these that improve the school's image, offer cost savings, provide teaching oppor-

tunities across the curriculum and incorporate student leadership and enthusiasm for the project. Administrators are often eager to support a Schoolyard Habitats project once they realize the connection between the school's curriculum requirements and the educational opportunities of a Schoolyard Habitats site.

▽

Where to Look – Community Resources

- *Cooperative Extension Service*
- *School PTA/PTO*
- *School Board of Education*
- *Federal and local resource management agencies (i.e.: Soil and Water Conservation District, U.S. Forest Service, U.S. Fish and Wildlife Service, federal or state Environmental Protection Agency, NRCS, etc.)*
- *Conservation and environmental groups*
- *Colleges and universities*
- *Garden clubs*
- *Corporate grantors and private foundations*
- *Businesses (i.e. local home and garden centers, nurseries, etc.)*
- *Civic organizations*
- *Boy Scouts/Girl Scouts*
- *Native Plant Society*
- *Local Master Gardeners*
- *Religious groups*
- *Neighboring businesses and/or homeowners*
- *Community members with NWF certified Backyard Habitats*
- *Students and teachers from certified SYH schools*
- *Colleges and Universities*
- *Local landscape designers*
- *Nature Centers*

Maintenance Staff

Invite maintenance staff members to provide input into the process. They possess valuable knowledge about the school grounds and possible equipment available for project construction and maintenance. Convey to the maintenance staff the purpose and scope of the project, and the important role they play and critical skills they bring to its long-term success. Early in the process, explain what will and won't be expected of the maintenance staff in terms of the habitat site. Generally, students and volunteers, not the maintenance staff, maintain Schoolyard Habitats sites.

Parents and Guardians

Parents and guardians enthusiastically support projects that excite, educate and stimulate their children. Ask them to volunteer to help with the process. For those unable to volunteer during school hours, set up after school or weekend volunteer times. Many parents have found their own lives enriched through involvement in a Schoolyard Habitats project. Their enthusiasm and resources – personal and professional – are valuable assets in the life of the project. The participation of parents and student family members is crucial to expanding the support and impact of the program beyond the school.

Local Businesses and Civic Organizations

In many successful Schoolyard Habitats projects, community partners offer technical support, material contributions, small grants, volunteers and other in-kind donations to habitat projects. As a result, these groups gain positive recognition in the community and, in turn, strengthen their customer or member base. Involvement by local businesses and organizations also serves to strengthen school-community relationships. Always acknowledge contributions to a Schoolyard Habitats project with letters of appreciation, and publicize the assistance given by local businesses.

Resource Professionals

Resource professionals offer invaluable knowledge and skills to

Schoolyard Habitats projects. Remember, because this is a local project, focus the search for "experts" locally. They bring expertise to the planning and development of specific habitat components, while also serving as positive role models and mentors for students.

Through workshops and school assemblies, their involvement with the project may open the eyes of students and others in the school community to new career directions and possibilities.

***Remember:** An essential goal of the Schoolyard Habitats project is to reflect ideas brought forth by the students, while attempting to incorporate those of the larger school community. Student involvement and leadership are vital to the habitat's success!*

Curriculum Committee

Although the planning and creation of the Schoolyard Habitats site may take several months, it is important to consider curriculum connections and educational uses of the habitat site from the very beginning. A **Curriculum Committee** therefore is an essential sub-group of the Habitat Team. In some Schoolyard Habitats sites, the Curriculum Committee is comprised of 3 or 4 teachers who meet on their own, but keep in close contact with other members of the Habitat Team. At other schools, faculty who already meet regularly to discuss curriculum (i.e. by grade-levels) set aside a portion of their planning time to discuss Schoolyard Habitats connections.

Once a habitat site is created, incorporating the site into instruction often becomes the responsibility of individual teachers. For all to benefit from the Schoolyard Habitats site's potential, it is important for the entire Habitat Team to keep all faculty informed during the planning and building stages. In a faculty bulletin, share with other educators the project rationale, project goals, status of the site and curricular possibilities under exploration. The more educators "on board" during the planning process, the more the completed Schoolyard Habitats site will be used, and the greater the numbers of students who will reap its educational rewards.

Resource Professionals

- *Forester*
- *Cooperative Extension agent*
- *Park naturalist*
- *Wastewater engineer*
- *Wildlife biologist*
- *Land-use planner*
- *Horticulturist*
- *Landscape architect*
- *Local historian*

Team Planning Sheet

Schoolyard Habitats

School: _____

Team members for the _____ school year:

	Role
Students:	
1.	
2.	
3.	
Educators: *example: Ms. Stowell, 4th Gr. teacher*	*curriculum coordinator*
1.	
2.	
3.	
Administrators:	
1.	
2.	
Maintenance Staff:	
1.	
2.	
Parents/Guardians: *example: Ms. Cooper*	*fundraising from local businesses*
1.	
2.	
3.	
Local businesses or organizations:	
1.	
2.	
3.	
Resource Professionals:	
1.	
2.	

Examples of roles to be filled: team leader, budget/fund-raising, curriculum coordinator, historian, maintenance, parent/volunteer coordinator, parish/district liaison, publicity, student liaison.

© Copyright 2001 National Wildlife Federation

Develop Your Vision

Creating a Vision Statement

Before setting your specific goals, take some time to develop a vision for your Schoolyard Habitats site that everyone can agree on. The process of developing this vision will aid in bringing together the community and generating enthusiasm and ownership for the project. Be sure to have everyone involved – from the students to teachers or leaders, administrators and community members. Work through the "Vision Worksheet" on page 13 and then have people respond to each other's differing visions in a large meeting, in an on-line forum, or in smaller groups. If possible, devote all or part of a PTA meeting and/or faculty meeting to filling out and discussing both the Vision Worksheet and the Goals worksheet, and to sharing student ideas with the audience. (Teachers should focus on gathering student input by working with as many students as possible on these sheets). You may want to use the Dream Habitats activity (p. 39) before your site inventory as part of this visioning process.

Setting the Goals

The next task of the Habitat Team is to define and set clear and attainable project goals. Long-term goals are essential. However, be sure to set short-term goals that are readily accomplished, to keep motivation high. The ongoing nature of these projects allows for additional time to locate funding and materials.

Sample Vision Statement:

"Our vision for a Schoolyard Habitats project is to provide a natural area that is aesthetically pleasing where wildlife can be observed and appreciated. This site will provide students with hands-on experiences that enhance all areas of the curriculum."

Examples of Specific Goals:

◇ *Dig up/dispose of asphalt on site* ◆ *Plant 7 native trees/shrubs* ◆ *Create 10' by 12' butterfly garden*
◇ *Put in 3 raised flower beds* ◆ *Identify learning standards that can be met in the Schoolyard Habitats site*

Vision worksheet

School:

Name:

Describe how your schoolyard currently looks:

What kinds of activities normally take place there?

If you could change your schoolyard in ONE way, what would it be?

If you could change your schoolyard in any and all ways, how would it look?

What would happen there? Who/what would use it?

Where will your Schoolyard Habitats site be located?

What size will it be?

Goals Worksheet

Target completion date

Long-term Goal for Our Schoolyard Habitats project:

Short Term Goals:	Projected Completion Date
1.	
2.	
3.	
4.	
5.	

© Copyright 2001 National Wildlife Federation

Site Inventory and Choosing your Site

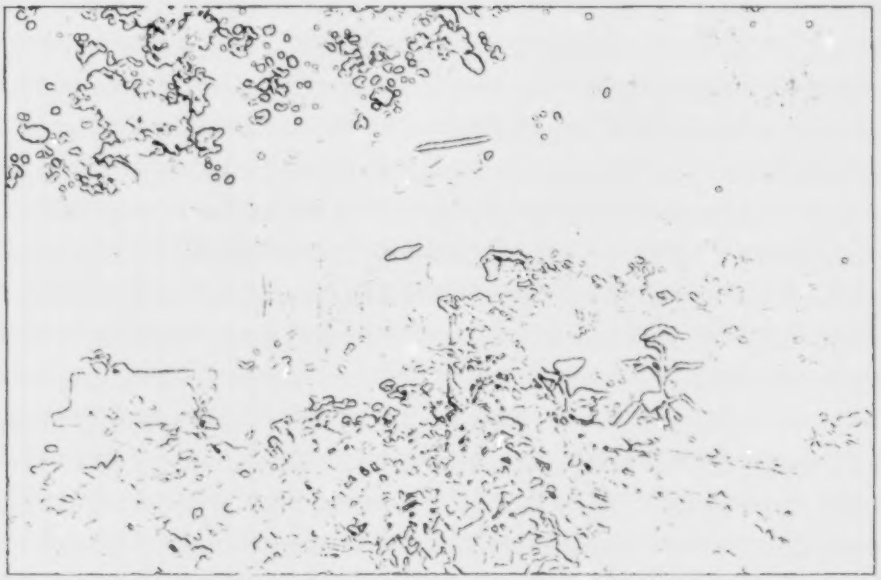
A site inventory is an important educational step in the development of a Schoolyard Habitats site. This may be the first time the Habitat team members and students step outside with a critical eye to assess the school grounds for its potential as an outdoor classroom and wildlife habitat. Before any decisions can be made about where or what will be planted on the Schoolyard Habitats site, everyone should have a thorough understanding of the different characteristics of the land on which they will work. The process of analyzing and creating an inventory of the site is a valuable teaching exercise for the entire Habitat Team and students of all ages. The inventory utilizes measuring and math skills, drawing, mapping, and observation skills. This experience can be an individual's first introduction to the ecology of the schoolyard. The following set of activities will guide you and your students through this process: Habitat Hunt, page 17; Wildlife Observation, page 20; Base Mapping, page 24; Dream Habitats, page 39; Plant Selection, page 44; Breaking New Ground, page 49; Planting your Wildlife Habitat site, page 52; Creating a Field and Care Guide, page 56.

In this first phase of the project, team members and students go outdoors to familiarize themselves with the schoolyard. The subsequent mapping activities will help students create a "big picture" of all the observations and data collected during the site inventory. These activities will be helpful in creating a connection between students and the site, and will also provide invaluable information for use in the planning process.

Conducting a thorough site analysis requires spending a good deal of time out on the site. During this process, the Habitat Team and students learn what occurs on the site in a day, and think about changes that may occur in the evenings or over the change of seasons. Each person will have a unique view of the site or an experience to contribute.

The site inventory should be as comprehensive as possible, looking at the physical elements of the site (such as soil type, topography, drainage patterns, pedestrian traffic) and ecological components (plants and animals already on the site). In addition to the natural characteristics of the site, it is important to note all human-designed components of the site, including buildings and asphalt areas.

Your site inventory should not stop at the edge of school property. Look beyond the school grounds to assess the neighboring areas. Who shares a common boundary with the site? If a city park exists next door, perhaps the habitat project can support existing wildlife habitat in the park. Or maybe neighbors would be interested in creating and connecting habitat corridors to backyards or woodlands.



In addition to the physical and ecological inventory, it is important to research the history of the school site. How was the land used before the school or other buildings were built? What kind of natural ecosystem was found on the school property? A historical inventory can be fascinating and is another great tool for involving the community. Have students interview long-time community residents and conduct other research with local historians, naturalists and others.

Creating a wildlife habitat area begins by understanding the proposed site and how the different elements of that site relate to each other and local wildlife. To fully understand this, the site must be closely examined, one component at a time. It is not necessary to be an expert or professional landscape designer to map and observe your habitat site. It is more important to create a connection between team members, students, and the site through the inventory process than it is to have a professional site design. This connection will result in an increased sense of ownership and stewardship for the project by those involved.

Site Inventory Elements

Elements of the site inventory include but are not limited to:

Traffic Patterns

- Study foot, auto and bicycle traffic on your site.
- Make note of all existing pathways (formal and informal). Check for signs of wildlife trails.

Water Flow / Topography

- Observe contours and slopes of the site. Note where water flows during times of rain and of areas where water drains or settles.

Existing Vegetation

- Make note of existing vegetation such as deciduous trees, evergreen trees, shrubs, long vs. short grass, natural vs. landscaped areas. Depending on ages of students, this step may include identification of specific species of plants.

Permanent Structures

- Take note of buildings (take into consideration location of doors and windows. Can you situate your habitat site so that it can be seen from class rooms? Is the site easily accessible for all students?)
- Record the location of sidewalks, driveways, parking lots, and loading areas
- Look for other human influences (i.e. playing fields, utility lines and towers)
- Make note of underground utilities or power lines
- Make note of water sources (both natural and municipal)

Signs of Wildlife

- Observe wildlife visiting your schoolyard, include actual sightings, tracks, scat and other signs of wildlife activity.

Soil Types

- Take soil samples from different areas of your site and compare color, texture and moisture content. Hint: Recruit a garden shop representative or an employee of the local soil and water conservation district to help with this part of the activity if no one in the group is familiar with soil pH and composition.

Sun and Shade

- Study which areas of the site receive the most sun and the most shade. How much does air temperature change throughout a day? Throughout the year?

Adjacent and Historical Land Use

- Consider how nearby neighbors utilize their land. Make note of any existing green spaces or large paved areas, for example.

- Investigate past land use and site history

As you go through the activities that follow, you may wish to create a class or group Schoolyard Habitats portfolio – either individually to use as an assessment tool, in small groups, or as a whole group. Each additional piece of information will be added to the portfolios, so that there will be a growing body of knowledge from which to draw in planning your site. See pages 24-33 for step-by-step instructions for the inventory process.

The activity on the next page allows students to explore their schoolyard, to learn about the basic wildlife habitat requirements, and to assess the schoolyard as a wildlife habitat.

Activity: Habitat Hunt

Summary

Students assess the schoolyard (or nearby park) as a habitat for local wildlife.

Grade Level: *K-8*

Time: *2 class periods (60 minutes)*

Subjects: *Science, Geography*

Skills: *Observation, description, analysis, research*

Learning Objectives:
Participants will be able to:

- *Locate habitat elements on the schoolyard*
- *Assess schoolyard's potential as a suitable habitat for a specific animal*
- *Identify an area of the schoolyard that would include the most habitat elements for a specific animal*

Materials:

- *Pictures of local wildlife*
- *Construction paper or flagging tape (4 colors)*
- *String (and/or masking tape)*
- *Single-hole punch*
- *4 colors of chalk or dry-erase markers*
- *Scissors*
- *Journal*
- *Pencil*
- *Tools for observing wildlife: field guides, binoculars, hand lenses (optional)*
- *Habitat Hunt worksheet (page 19)*
- *Field Guides*

Background

In order for an animal to survive as a species, it must be able to find adequate habitat that provides food, water, cover, and a safe place to raise its young. The amount and quality of these needs vary a great deal from species to species. It may be that your schoolyard already has adequate habitat for some animals – students may have seen squirrels romping around in nearby trees, or have heard songbirds in the spring. This activity may answer questions as to what these animals are finding in your schoolyard, and what they and other species may lack.

Identifying and locating the elements already present on school grounds represents the first step in restoring wildlife habitat. From there, you will better understand ways to attract and help support a wider variety of local wildlife.

Preparation

Cut construction paper into "flags" (a rectangle quarter of a page) and punch a single hole in the top, or set out materials for students to do this during class time. Alternatively, provide 4 colors of flagging tape. Each student, should have 4 flags, one of each color. Designate one color for food, one for water, one for cover, and one for places to raise young. If necessary, have students label each of the flags.

Procedure

1. Review the four basic elements of habitat and the importance of each for animal survival.

2. Pass out the Habitat Hunt worksheet on page 19. Tell students they will complete these during an exploration of the school grounds. (If the area to explore will be limited to certain sections of the school grounds, state the boundaries of the area). They will look at the school grounds as if they were a local animal species in search of habitat.

3. Have students choose a local animal species common to the area. Using field guides or storybooks (K-3), identify the types of food, water cover and places to raise young that their animal requires.

4. Pass out construction paper flags so each student has one flag of each color. Tell students they will use the flags to tag the area where a habitat element for their animal is located on the school grounds. One color represents food, one represents water, one cover and the other places to raise young. Have the student write the name of their species on each flag so they will be able to tell them apart from those of other students. Have them cut string and punch a hole in each flag (if not already done) so they can tie flags outside.

5. While students are outside, they will need to think about the following:

- In order to survive, all animals need food, water, cover and a safe place to raise their young.
- When outside, take a look around you. Do you see the necessary habitat elements for the animal you have chosen to survive here? Spend some time exploring this area. Look for all the characteristics of habitat that meet your specific needs. Based on what you find, you will decide to stay and call this area "home" or continue to look for a new place to call home.
- Describe the four elements of habitat you found that meet your needs:
  ✔ Food ✔ Water
  ✔ Cover ✔ Places to Raise Young
- Note where you found each element. Are they spaced close together or spread out over the school grounds?
- Decide whether you (as the animal) would stay and set up home here. Why or why not? What other habitat elements would need to be added for you to stay here?

6. Before going outside, review any safety rules with the class (see Kit Tips Module for tips on working outdoors with students). If the area is too large, consider setting up boundaries for the activity. Depending on the age range, have students stay together as a group, or allow them to investigate the school grounds on their own. They are searching for a new habitat for their animal, but first they must identify which of the four basic habitat elements are on school grounds. As they explore the schoolyard in the role of the animal, students will use the different colored flags to identify as many habitat elements as they can find for their animal. These may vary for different animals and not all the students are likely to locate all four elements for their animals.

7. After they place each flag, participants will use the Habitat Hunt worksheets and/or student journals to record what and where they found all or some of what they need to survive. While outside, be sure to help students if they feel unable to identify the elements.

8. Once all students are finished, tour the schoolyard together and collect the flags. Discuss the habitat elements each flag signals. After the exploration, have the class assess its findings. If possible, use chalkboard (a dry-erase board or overhead and transparency will work as well) to draw a simple map of the area explored during the activity. Have each child come to the board and add the location of the elements they flagged to the map. Each element should be represented by a different color of chalk (or marker). As a class, discuss the map. Which areas on the schoolyard have the most habitat elements? How many different species might each section support? Ask each student to decide if the schoolyard would be part or all of their animal's habitat. What habitat elements may need to be added to enhance or create adequate wildlife habitat?

For older children: Have participants put the information they discover directly onto maps, rather than using flags.

Extensions

Challenge students to think about how the availability of certain habitat elements may change through the seasons. Would water be more difficult to get for wildlife in summer or winter? Are small streams, ponds and puddles they may have seen available for wildlife all the time? What about food?

Assessment

Have students write a short essay describing their findings in the schoolyard and how the area meets and does not meet their animal's needs. How would the schoolyard need to change to become a better habitat? You may want to instruct younger students (K-3) to draw pictures of their animals habitat needs.

Worksheet

Habitat Hunt

Directions:

You are a _____ In order to survive you need Food, Water, Cover, and Places to Raise Your Young. Explore the schoolyard. Describe the habitat elements you find and where you find them. Then, decide whether or not you could stay and make your home here.

Food Source:

Water Source

Cover:

Places to Raise Young:

Questions:

1. Will you stay and make your home here?

2. Why or why not?

3. What other habitat elements would you like to see here?

© Copyright 2001 National Wildlife Federation

Activity 5

Wildlife Observation

National Wildlife Federation

Summary

Participants hone their observation skills and gain a sense of what wildlife is already utilizing their schoolyard.

Grade level: *3-8*

Time:
1 class period

Subjects:
Science, writing

Skills: *Observation, description*

Learning Objectives:
Students will be able to:
- *Identify wildlife currently using their schoolyard*
- *Describe several ways in which observed animals (or those who left signs) are using the schoolyard*
- *Make careful observations*

Materials:
- *Binoculars and hand lenses if available*
- *Clipboards*
- *Animal Observation work sheet, Wildlife Clues sheet, p22-23*
- *Pencils*

Background

Students might be interested to know what wildlife already uses (or does not use) the schoolyard.

Additionally, this activity gives students the chance to hone their observation skills.

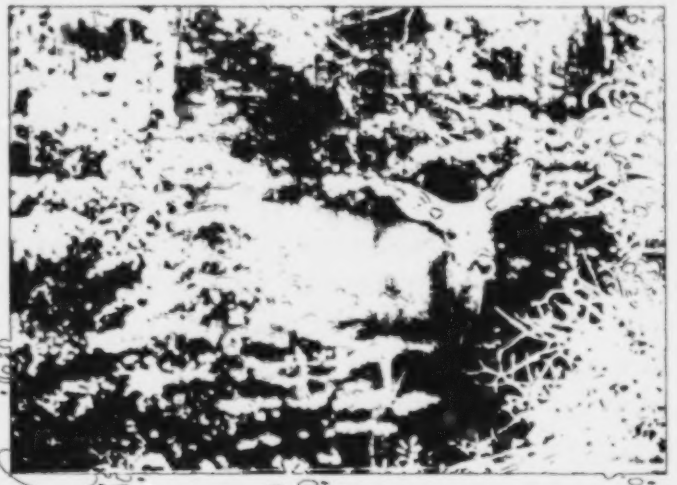
As a teacher, you will want to familiarize yourself with some of the local wildlife that students are likely to observe. Take some time before this activity to walk around the school grounds and see what you can find.

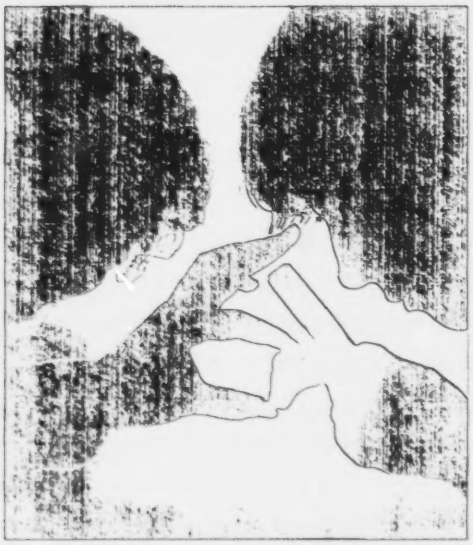
Procedures

1. Ask students what animals they think the animal they "became" in the previous activity is already present in the schoolyard. Why or why not?

2. Explain to students that they will now spend some time observing their schoolyard to determine what wildlife, if any, is currently using it as part or all of its habitat.

3. Hand out the Wildlife Clues sheet and the Observation Sheet, page 22-23, along with clipboards, pencils, binoculars (optional), and hand lenses if available. Take a few moments to go over the wildlife clues sheet. Ask if students have seen any of these clues before; show examples if you have any available. Ask if there are any questions, or if students can think of additional clues that they can add to the bottom of the sheet.





4. Tell students that they will need to be very quiet to observe wildlife, especially if they want to see sensitive animals like many birds. Sudden noises and movements might scare animals away. Once outside, each student will pick one place to sit, at least 5 yards away from any other student. If needed, assign each student to a specific place. They should pick a comfortable position – sitting, lying on the grass, or even standing if they prefer. They will stay there for 5-20 minutes depending on the age of the students, and record every animal they see or hear, either on the ground, trees, in water if available, or in the air. If they know the names of animals they see, they should record them, but if not, they can draw a quick sketch and identify them later. They could also use words to represent the sounds that they hear. Remind students to look not only for big animals that are easy to see, but also for little ones on the ground, like insects. Also remind them to listen carefully as well as look. Binoculars and hand lenses will help observations.

5. After the quiet period, tell students that they will now remain silent but walk slowly around the area looking for wildlife clues and recording all they find without talking to each other. Students may be able to hear a bird call (even if they can't see the bird), find animal homes (e.g., bird nests, insect galls, ant hills, underground burrows), or find other clues such as animal tracks, animal scat, nibbled leaves or broken spider webs. Give students 15 minutes to do this.

6. When the time is over, reconvene students in the classroom to exchange information. What did they see? Where was wildlife observed? Did students observe the animal they were role-playing in the previous activity? What kinds of clues did they find? What was missing that they would have liked to see? How did they feel while making observations? If no wildlife was observed, why do they think this was so? What can they do to attract more wildlife in the future? Record all this information on a large flip chart.

Extension

If possible, arrange to have students repeat this exercise at different periods of the day – either very early in the morning, or at dusk. See if they can discover any differences.

Assessment

Have students create a chart showing each animal they observed or sounds of wildlife they found, and the ways it could meet its habitat needs in the schoolyard or nearby areas.

Worksheet

Animal Observation

National Wildlife Federation

Your location: _____

Time of day: _____

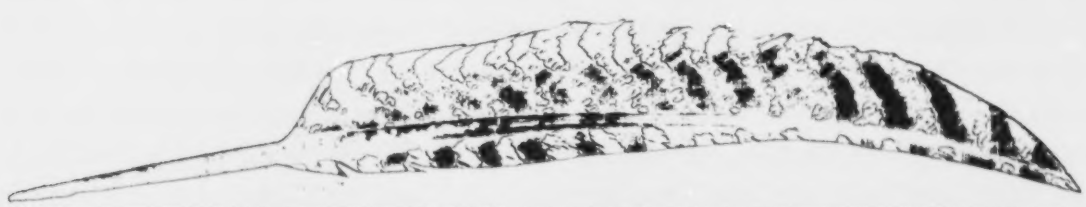
Animal Observed	Location	Activity	Sketch

© Copyright 2001 National Wildlife Federation

Wildlife Clues

Often animals are hard to spot during the day, particularly in areas near a lot of people. When you look closely, however, you will find signs that animals have been nearby. Below is a list of some wildlife clues to look for - see if you can find these and other wildlife signs as you explore.

- ✔ Green leaves with irregular edges are a clue that some one's been eating that leaf – it could be an insect or a deer.
- ✔ Hairs caught on a fence suggests that a fox, sheep, rabbit or other mammal might live close by.
- ✔ A trail that leads nowhere (or under fallen logs and through bushes) might be a path made by a number of different animals such as a deer or rabbit.
- ✔ Pieces of moth or butterfly wings show that a bat, bird, or spider has been eating.
- ✔ Gnawed or stripped bark on a tree could be the calling card of rabbits, squirrels, deer or even some wood-eating insects. Bark carved with initials suggests a different suspect – a human.
- ✔ A flattened circle of grass or leaves is the clue left by an animal lying down.
- ✔ See feathers on the ground? They are probably from a bird that either stopped by, or was eaten there.
- ✔ A dug-out area in the base of a tree might be a fox den.
- ✔ Medium-sized holes in the ground might mean a rabbit's burrow. Rabbits also make grass nests along sandy banks, under bushes or in fields. Look for rabbit pellets (feces) and fur near the holes.
- ✔ Leaves and twigs make up a squirrel's nest on tree branches or in tree holes.
- ✔ A tree with a hole bored in it is a clue that a woodpecker is active nearby.
- ✔ A tree hole that's partially filled in with dry mud could be a nuthatch nest.
- ✔ A spider web (whole or broken) is a spider's trap to catch food.
- ✔ A small mound with a hole on the top is a sign of an ant hill
- ✔ Twigs and branches carefully put together in a nest is the work of a bird. To find bird nests, participants should look high and low, in shrubs, grasses and in trees. Building ledges, eaves of houses, telephone poles and other man-made structures also provide good spots for nests.
- ✔ A gall (a strange outgrowth on a tree that looks as if a baseball or other object was stuck under the bark) may mean that insects are inside.
- ✔ A hive may be buzzing with bees.
- ✔ Animal tracks (use a field guide to help you identify) show an animal's trail.
- ✔ Small holes in ground may be home to moles or other burrowing mammals. Larger holes may be the work of a groundhog.
- ✔ Gnawed fruit stones and seeds mean a mouse, vole, squirrel or other gnawing rodent is probably near.
- ✔ Egg masses left on leaves indicate an insect.
- ✔ Sounds of bird song or insects buzzing tell you these animals are very close.
- ✔ Mounds of dirt suggest there are tunnels below surface, a mole or chipmunk, perhaps.



Activity

Base Mapping & Schoolyard Inventory

National Wildlife Federation

Summary

Students create a base map of the schoolyard, then conduct a site inventory of the grounds, mapping the physical and human elements. Students then assess the schoolyard for its habitat potential and identify a site for a Schoolyard Habitats project.

Grade level: 5-8; K-4

Time: *3-7 class periods (depending on size of class, team structure, and size of area to be mapped)*

Subjects Science: *Math, Geography, Art, Science*

Skills: Research, analysis, observation, description

Learning Objectives:
Students will be able to:
- *Identify existing natural and artificial characteristics of available land*
- *Create a basic map of the area*
- *Select an appropriate site for the creation of a habitat area within the land available*

Materials:
- *Field guides*
- *Paper and pencils*
- *Clipboards (if available)*
- *Compasses*
- *A large poster or interactive creation to show different parts of compass*
- *Sample site maps or drawings*
- *Worksheets, pp 27-33*
- *Overhead projector and transparencies, - OR - Graph paper, poster board or butcher paper (see note at end of activity if a projector is not available)*
- *Different colored overhead transparency markers, - OR – crayons, and/or colored pencils*
- *Rulers and markers*
- *Journals*
- *Thermometers*

For younger participants:
(see note at end of activity)
- *Field guides with large color pictures*
- *Butcher paper or cardboard*
- *Colored clay, construction paper, and/or building blocks*
- *Odds and ends to represent different parts of site*
- *Scissors, glue*

Procedure

1. Go out on the school grounds or site at various times during the day. Have students consider the following questions and make notes in their journals. If they do not yet have journals, they should create simple ones.

- How do you feel when you are at the site? Comfortable? Exposed?
- Where is your favorite place? Why?
- Where is your least favorite place? Why?
- Where are the best views?
- Where is the quietest spot? The noisiest spot?

2. Tell participants that they will all help to create a base map of their school grounds or site. This map will include many different features of the site. Explain the following process: Students will begin by creating a very simple map together, and will learn how to orient themselves using this map and a compass. The next part can be done in a number of different ways. Depending on the size and level of your group, and time available, you may wish to have all your students do each activity, perhaps one each class period. Alternatively, you may wish to divide your students into small teams, each charged with investigating and mapping a different feature. When all groups have finished conducting their research, they will assemble everything together to create one very detailed map. Show sample maps or drawings to illustrate each feature that a team will map.

3. Construct an outline map of the site as a group. The students can help create this map, but you should make sure that it accurately reflects what the site looks like. The outline map should be a fairly simple sketch of the area (see samples on following pages). Identify an appropriate scale. The map should include all borders, such as property lines, sidewalks, roads, etc., and any large permanent features such as buildings (showing exits and entrances), fences, power lines and ball fields. The outline map can be drawn on a transparency and shown on an overhead projector (if an overhead projector is not available, or if the majority of students are 4th grade or below, see notes at end of this activity).

4. If the outline map is on a transparency, create one copy per group on white or solid colored paper and place them each on a separate clipboard. Put an overhead transparency on top of the outline map. Students will map directly on the overhead transparency and not on the base map itself.

5. If you are using teams, divide students into small groups. If possible, assign a volunteer or older student to assist each group. Explain to students that each team will be responsible for mapping different features of the site. You will need the following teams:

- ◇ Traffic patterns team: to study foot, auto and bicycle traffic on your site
- ◇ Water Flow/Topography Team: to observe contours and slopes of the site
- ◇ Existing vegetation team
- ◇ Soil Team
- ◇ Sun/Shade Team
- ◇ Adjacent Land Use Team
- ◇ History Team

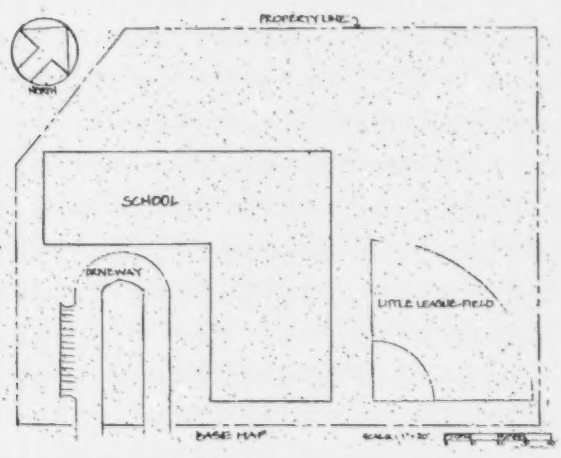
Consider encouraging each team to come up with a name for itself, relating to what it will do.

6. Show the outline map to students and explain what they see in detail. Students should be able to identify several landmarks on the map.

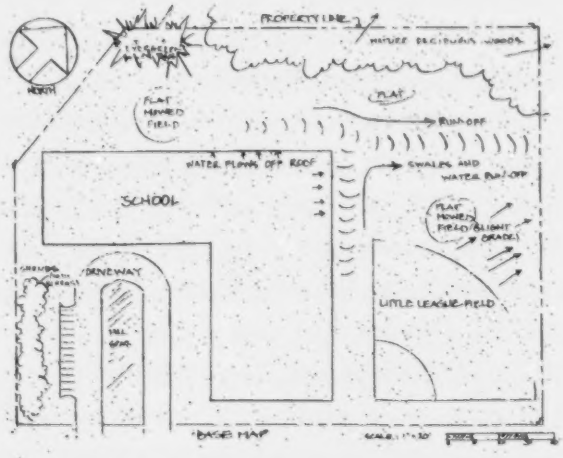
7. Give each group the appropriate inventory sheet to assist them in their investigation. Go through each sheet and explain what each item is and why it may be important. For example, traffic patterns are important because you do not want your habitat site in the middle of a high traffic area. Give each team a different colored overhead marker to map its assigned feature. Each type of site feature should be drawn in a different color to avoid confusion. Encourage all group members to help draw the site feature on the transparency.

8. Hand out clipboards and a compass to each group. Make sure at least one leader or volunteer is familiar with using a compass before beginning this exercise. Explain to participants that once they are outside, they should try to locate north with the compass, and then find it on the map. If anyone does not know how to use a compass, be sure to explain clearly how it works. Depending on the level of your students, you may want to do a separate compass activity prior to beginning this activity. See Appendix #2 for instruction.

9. Once outside, show participants how to use the compasses, and let them try to figure out which part of the map points to the north. Tell them to find a corner of the map, draw a small arrow on it so that the arrow is pointing north, and label the arrow with the letter "N".

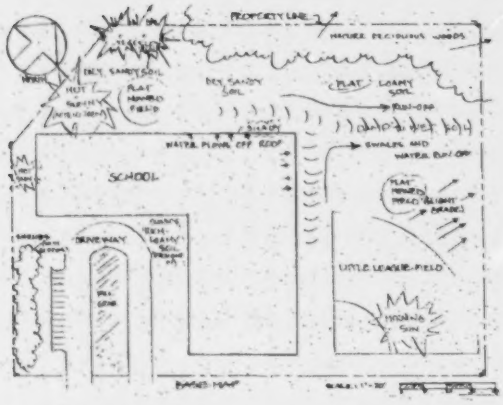


Base Map

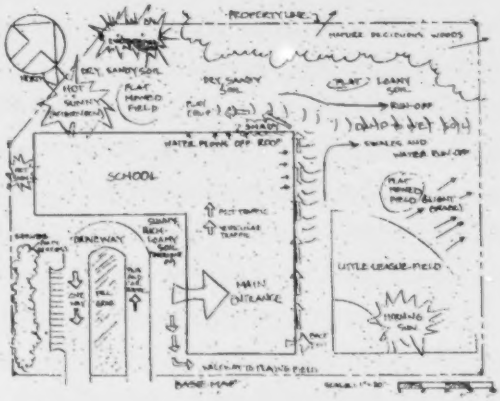


Water Flow & Existing Vegetation Map

BEST COPY AVAILABLE



Soils, Sun & Shade Map



Traffic Patterns & Human Use Map

Check and make sure that the arrows are all pointing the same way, and that each group can name a few of the features on the map before going to the next step. Participants need to know where they are in relation to things on the map so that they draw their feature maps in the same direction.

10. Once groups have finished with their site feature maps, bring them back inside and place the base map on the projector. Put each feature map (ie: traffic pattern, soil) on the projector one by one. Have groups explain what their maps show. If participants are working from a piece of graph paper, have them share and discuss maps with class. Ask students to think about how their findings might affect their habitat decisions.

11. After discussing each transparency individually, place all the transparencies on the projector one at a time until they make one very detailed map. Ask students if all the maps together show them a good location for their project. Wrap up by reinforcing the importance of the site map. Ask the participants if they learned anything about the site that they did not notice earlier. What can they do with this information? Explain that they are now ready to move on in selecting and planning a site.

Note: *If an overhead projector is not available, create the base map on a large piece of poster or butcher paper. Make small copies of the base map on pieces of graph paper and have these serve as the site feature maps for participants. Another option is to put tracing paper over the graph paper so that the base map can be reused. When everyone gathers together after they have investigated their site features, have them explain their investigations and methods, present their findings and conclusions they have drawn from their work, and draw their part on the large map.*

Adaptations for younger participants

Students in grades K-3 may have trouble understanding the abstract qualities of a two-dimensional map. For this age group, consider making one large three-dimensional model of the school building, out of blocks or other materials. Take students outside to assess the various inventory components. Then use symbols (i.e., blue construction paper for water) to represent what they found. Have students place these symbols around their model to show the results of the class inventory. When all everything has been incorporated, ask students what they learned about their site. Wrap up by having students look for patterns in their model that might point to a good place to put their wildlife habitat site.

BEST COPY AVAILABLE

Worksheet

Traffic Pattern Team

Team Name:

Look for:

1. Use of the site by people on foot: (i.e. Where do people gather, walk, etc.?)

2. Bicycle use:

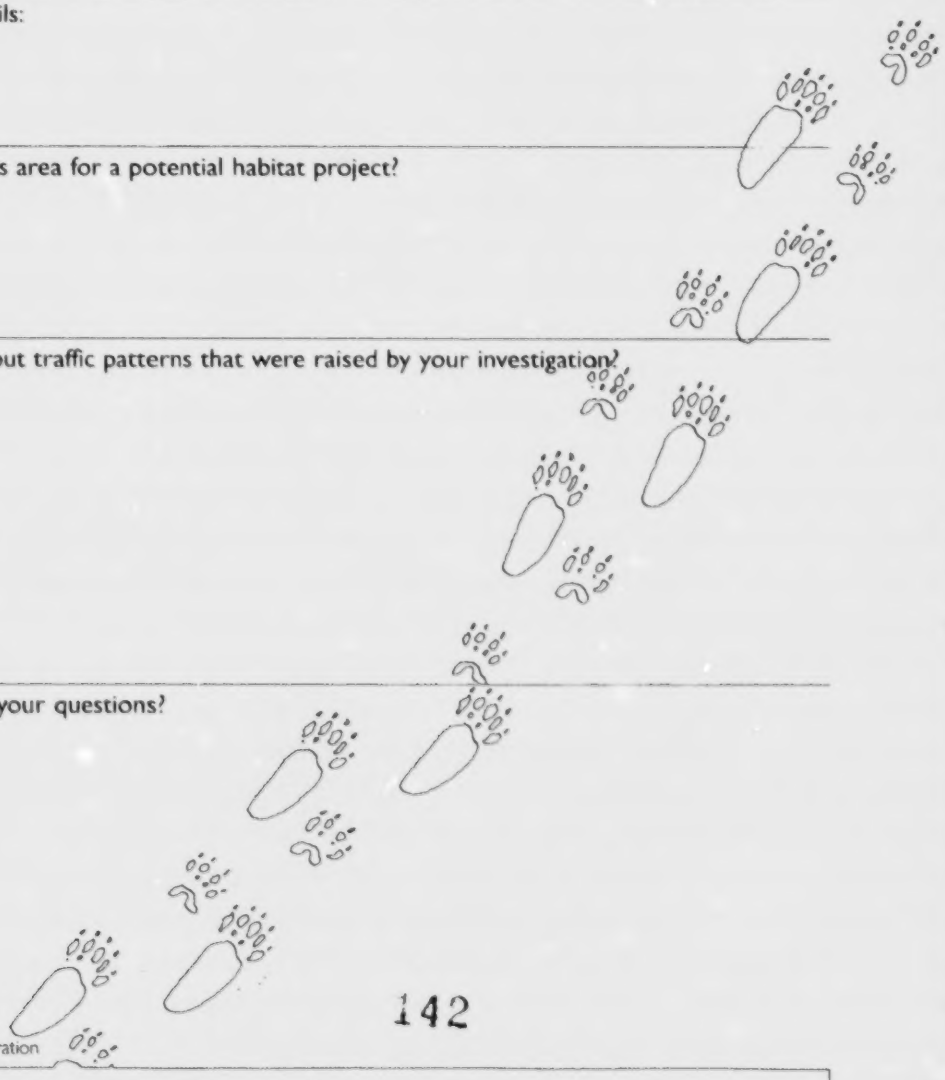
3. Auto use:

4. Any pathways or wildlife trails:

Any potential conflicts with this area for a potential habitat project?

Do you have any questions about traffic patterns that were raised by your investigation?

How might you try to answer your questions?



© Copyright 2001 National Wildlife Federation

Worksheet

Topography Team

National Wildlife Federation

Team Name: _____

1. Do you observe any hills, valleys or slopes?

2. Where does water flow when it rains?

3. Are there areas that usually hold puddles?

Why?

4. Make note of any pipes, storm drains, sewers, on your map.

5. Find out how often it rains in your area:

6. Find out how much rain your area gets per month or per year:

7. What questions do you have about the shape of your area and how it will affect your choice of site?

How will you answer these questions?

© Copyright 2001 National Wildlife Federation

Worksheet

Vegetation Team

Team Name:

Do a survey of the vegetation at your site. Note each observation on your base map.

Do you see:

1. Deciduous trees (those that lose their leaves in fall)?

2. Evergreen trees (those that keep their leaves or needles, all year)?

3. Shrubs?

4. Long or short grass?

5. Natural areas?

6. Landscaped areas?

7. What kind of each type of vegetation do you see? Use field guides to try to identify each one.

8. Are there a lot more of one type than another? Why do you think that might be?

9. What do you want to know about the vegetation that you've found here?

© Copyright 2001 National Wildlife Federation

Worksheet

Soil Team

National Wildlife Federation

Team Name: _____

Instructions: Gather at least 5 soil samples from different areas of your schoolyard on a day at least 3 days after the last rain. Pick areas that have different kinds of vegetation growing, or different topography – such as a hill, by a stream, under a tree, on the open ground, etc. Compare the color, texture, and moisture content of each sample. The pH measures how acidic the soil is; this determines what kind of plants can grow there. If possible, obtain pH-testing materials for gathering this information.

Sample #	Color	Texture (sand, silt, clay)	Moisture	pH

What questions do you have about the soils you found at your site?

How might you start to answer them?

© Copyright 2001 National Wildlife Federation

Worksheet

Sun and Shade Team

Team Name:

Directions: Choose a sunny day to do your investigation. On a scale of 1-5 record on your map how much sun is falling on different sections of the potential site. Places that have no shade at all and are under bright sun should get 1's, while those that are under complete shade should get 5's. Record air and soil temperatures at each location. Try to repeat your observations and measurements at two other times of the day, to compare.

Full Sun | 1 | 2 | 3 | 4 | 5 | **Full Shade**

Location	Time Recorded	Sun/Shade Rating	Air Temp.	Soil Temperature

What questions do you have about the temperatures and sun/shade conditions you discovered?

Why is it important to know which areas are sunny or shady before choosing plants for your habitat site?
How will sunny and shady areas change with the seasons?

© Copyright 2001 National Wildlife Federation

Worksheet

Land Use Team

National Wildlife Federation

Team Name: _____

How is land used on your school grounds now?

How do your site's neighbors use their land?

How might that affect your Schoolyard Habitats project?

Do a survey of the surrounding areas, recording on all sides what you find.
(Examples: forest, buildings, pool)

Direction from site	Land Use	Possible Effects on Our Site
Example: N, S, E, W	*road*	*may generate fumes, noise*

What other questions do you have about land uses in your area?

© Copyright 2001 National Wildlife Federation

History/Local People Survey Team Worksheet

Team Name _____

Instructions: In your group, generate a list of questions about your site and a list of people you think might be able to help you answer them, or whose opinions you would like to consider. Before the interview, make up an interview sheet, with all your questions written out, and with room for answers. Conduct an interview with each person (at least 3 different people), recording their answers carefully. Be prepared to present your findings to the whole group. Some ideas are below, but add your own – these are only to get you started!

People to interview:

- ☐ Long-time town resident
- ☐ Principal
- ☐ Parent who attended your school many years ago
- ☐ Local farmer
- ☐ Local business people
- ☐ Local nature center director
- ☐ Urban forester
- ☐ Long-time teacher

Sample questions:

- ■ How long has this site been here?
- ■ What was here before?
- ■ What species of wildlife did you see here many years ago?
- ■ What do you think of creating a wildlife habitat here now?
- ■ Do you think it would help or hurt the local community?
- ■ Do you have any concerns about a habitat site here? What are they?
- ■ Can you recommend any resources that might help us with this project?

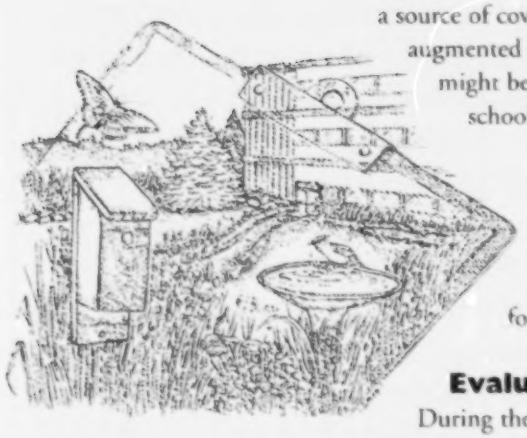
© Copyright 2001 National Wildlife Federation

Summarizing the Data

After the site inventory is complete, let participants know that the information gathered in the inventory will be referred to throughout the planning and design process. To be most useful, the information should be gathered and summarized. This should include the base map overlays, tables, charts, graphs, and narrative summaries.

Defining the Site

Once all the data is summarized, Habitat Team members can evaluate which area of the schoolyard is the best suited for a habitat site. Examine the summarized data and determine if the schoolyard has the essential habitat elements. While you are doing this, you should be able to determine where the Schoolyard Habitats site should be located. In some cases, a certain site may have already been designated. In other cases, students might have found that some areas of the schoolyard might already be frequented by wildlife. These areas may naturally provide some or all of the essential habitat elements. For example, perhaps your site inventory identified a small grouping of bushes in the corner of the site surrounded by turf grass. This would be an excellent place to start. The existing shrubs, if fruit bearing, may provide a source of food for local and migratory birds, while also providing a source of cover from potential predators. The clump of shrubs could be augmented by a couple of young trees, ground cover and a water source. It might be better to start here than a barren piece of land in the middle of the schoolyard.



Keep in mind the needs of both wildlife and humans. Plan the site to be accessible for classes to use (see Appendix #1) and for community members to visit. Guide students through this process of identifying the portion of the schoolyard or larger site best suited for a wildlife habitat area.

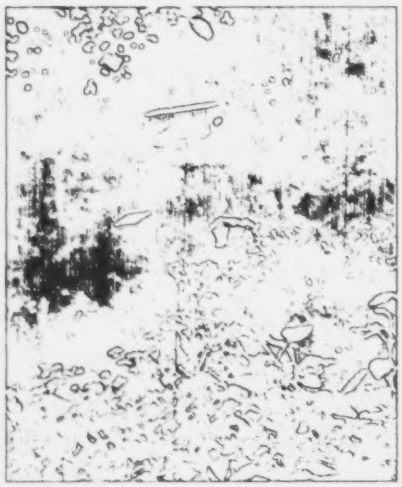
Evaluating the Site

During the site inventory, students identified existing wildlife habitat components on the schoolyard. In this step, students focus on the chosen site and determine which habitat elements must be enhanced or developed to attract wildlife. What was found? What needs to be added or changed?

When analyzing the new habitat site, keep in mind the four essential elements of a habitat – *food, water, cover,* and *places to raise young* . As a general rule of thumb, the greatest diversity of habitat elements will attract the greatest number of birds and other animals to the Schoolyard Habitats site.

You may want to use the worksheet on page 38 to help you with this process.

Food

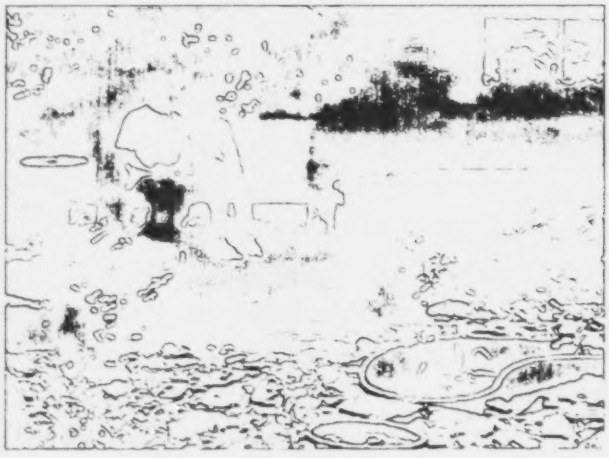


The ideal wildlife management plan uses regionally native vegetation to supply as much food as possible to meet the year-round needs of many species. Shrubs, trees and other plants produce foods, such as acorns, nuts, berries and other seeds. Leaves, buds, catkins, nectar and pollen are equally important food sources.

Remember that **native plants** are the basis for the food chains in any given ecosystem. To attract local wildlife, use regionally native plant species, including trees, shrubs, perennials and annuals. Plants native to the soils and climate of your region provide the best overall food sources for wildlife. At the same time, they require less fertilizer, less water and less effort in controlling pests. Native plants may support 10 to 50 times as many species of wildlife as non-native plants. To identify plants native to your region, contact NWF, a local or state native plant society, a Cooperative Extension office, local garden center, state non-game wildlife program or nature center (see Resources section).

While plants are maturing, and during the winter months, natural food sources may need to be supplemented with feed. In bird feeders, use seeds from sunflowers, nigers, safflowers or proso millet and add cracked corn, meal worms or suet. In warm months, mix four parts water to one part sugar for hummingbird feeders, to supplement the birds' nectar and insect diet. Remember it is extremely important to keep bird feeders clean. Regular cleaning will prevent disease transmission to the birds.

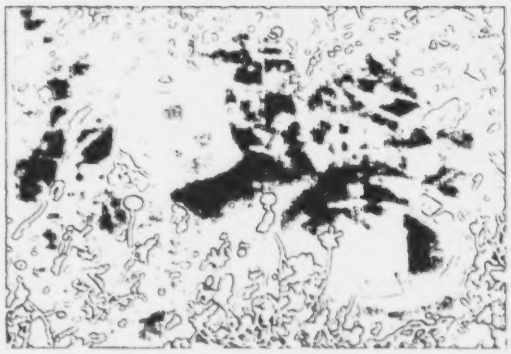
Water



Throughout the year, wildlife needs water for drinking and bathing. Students may supply water in a birdbath, a small pond, a wetland or marsh, a waterfall powered by a re-circulating pump, or even a a shallow dish. While vegetation holds droplets from rain or morning dew, a more constant, reliable source of water is a key element in a wildlife habitat site.

An elevated birdbath may protect birds from cats and other predators, and can be an attractive addition to the Schoolyard Habitats site. A shallow, wide-rimmed dish will provide water for small animals when placed on the ground near shrubbery or other cover. A small pond set into the ground can provide water for drinking, bathing, cover and reproductive areas for small fish, amphibians and insects.

In summer heat, be sure to replace water regularly and to keep birdbaths clean. In places where winter temperatures drop below freezing, maintaining a birdbath will involve either providing a birdbath heater or removing ice and refilling the bath with water daily.



Cover

Wildlife needs protective cover for raising young and hiding from predators. Plants that offer food can also provide cover. Densely branched shrubs, hollow logs, rock piles, brush piles, stone walls, evergreens, meadow or prairie patches and water provide cover for many animal species.

The ideal wildlife habitat area includes plants ranging in size and density from ground cover to tall, mature trees, including both evergreen and deciduous species. This variety of plant life provides birds and other animals with appropriate cover for feeding, hiding, courting and nesting activities.

Places to Raise Young

Wildlife also need safe areas for courtship and for nurturing young animals. To make a wildlife habitat complete, incorporate safe areas for breeding and egg-laying tailored to the needs of certain species. For example, include specific native plants upon which butterfly caterpillars depend or a shallow pond for tadpoles.

In providing places to raise young, consider using vegetation as well as human-made devices. Attach bird houses and nesting shelves to posts, trees or buildings. Maintain as many snags (dead, standing trees with hollow cavities) as possible. If den trees aren't available, erect bat and squirrel boxes for safe rearing areas. Plant dense pockets of shrubbery to provide safe areas for birds to nest.

Some of our most interesting animals require a body of water as a safe haven for their young. Many salamanders, frogs, toads and insects (including dragonflies and water boatmen) begin life in water and are unlikely to prosper without the safe, healthy water environment offered by a stream or small pond.

151

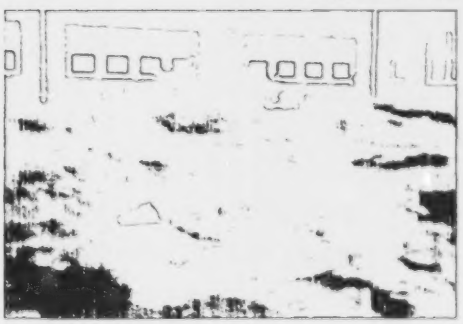
Schoolyard Habitats Design

At this stage, students should create a list of "essential" components they will need to add to the chosen site. For example, if during the site inventory students found no water source for wildlife on the site, water would be one of the essentials, even though the group has yet to decide how water will be provided or where it will be located. Before beginning this next stage, have the class brainstorm about other essentials to add to the list. Then, students and the Habitat Team will be ready to start designing the Schoolyard Habitats site.

In the design process, take into consideration any features that will make the site more accessible as a learning environment. Many schools include some type of seating area (which can range from a circle of tree stumps cut from a fallen tree to picnic tables), or an open area where a class could gather. Consider pathways that allow access to many parts of the habitat (winding paths sometimes lend more access to plantings than do single straight ones). Of course, the use of these features will vary depending on the size of the site. Also think about features such as interpretive signs, microscope stands, viewing scopes, and any others you think would be useful.

If your school has limited space, consider a container garden or rooftop habitat. see Appendix #3 for more information.

Share the lists of essentials with students and other Habitat Team members. These elements must be included as they create their dream habitat designs in the Dream Habitats activity. This activity is geared toward students, but Habitat Team members also should draft their ideas. Consider asking other interested members of the school and local community to create their dream habitats as well.



Worksheet

Essential Schoolyard Habitat Elements

National Wildlife Federation

School:

Date:

To provide enough food, water, shelter, and places to raise young for wildlife, and places for people to use and enjoy the space, we recommend adding the elements below:

1.

2.

3.

4.

5.

6.

7.

© Copyright 2001 National Wildlife Federation

Activity
Dream Habitats

Summary
Students will use the information they have gathered in the site inventory to make recommendations about what should be included in their schoolyard habitats site.

Grade Level: *2-8*

Time:
2-3 class periods

Subjects:
Writing, Math, Art, Science

Skills: *Analysis, description, comparison*

Learning Objectives:
Students will be able to:

- *Compile and synthesize information collected in prior activities to prepare feasible ideas for the schoolyard site*
- *Create a model Schoolyard Habitat*
- *Present ideas clearly and concisely*

Materials:
- *Cardboard*
- *Art materials*
- *Clay*
- *Paint*
- *Natural materials (e.g. pebbles, sticks, dried leaves)*
- *Library books (on various garden features)*
- *Garden magazines*
- *Native seed catalog*
- *Dream Habitat Worksheet (p.42)*
- *Peer Assessment forms (p. 41)*

Preparation - Getting Inspired

Before beginning this activity, take some time to trigger student imaginations. The richer and more varied their experience with and exposure to gardens and wildlife habitats prior to the activity, the more detailed their dream maps will become. Depending on time and resources, take students to a nearby botanical garden, community garden, children's garden or a certified Schoolyard Habitats site (visit www.nwf.org for a current list) to give them ideas about their own site. When visiting a garden or natural area, make sure students have quiet time to enjoy the place, write in a journal or talk about how they feel when they are there, and what they like about the outdoor area. These pleasing features are the types of things they will want to have fresh in their minds when they create their Dream Habitat. This will also give students a chance to make a link between the environment and how they feel. One of the many side benefits of Schoolyard Habitats sites and other school greening projects is the peaceful oasis they provide for youth.

If a field trip is not feasible, consider sharing some of the wonderful gardening books written for children. Stories with illustrations of gardens visited by wildlife and students, or that contain a wide variety of garden features, would be ideal. Also consider books which tell stories of the successful transformation of a small area into a community-building, flourishing garden, such as *City Green* by Dyanne DiSalvo-Ryan or The *Garden of Happiness* by Erika Tamar. Otherwise, have students close their eyes, while the teacher reads a vivid description of a wildlife habitat and all that a visitor might hear, smell, feel and see while there.

Procedures:

1. Creating Our Dream Habitats
After visiting an inspirational outdoor area, students will be ready to design their Dream Habitats. Take students to the location of the future Schoolyard Habitats project to remind them of the site's size and shape and the information they have gathered from their site inventory. Give them quiet time to sit in the area, make note of what is currently there and begin thinking about wildlife they would like to see invited into their schoolyard and new features they would like to see added based on their findings during their inventory.

2. Back in the classroom, remind students of the four essential components of habitat that must be included in their design. Have them think about other features they might enjoy in the habitat. If they went on a field trip, as recommended above, have them review notes and think about the features of the outdoor space they liked. Prior to the class, check out a number of library books or magazines for students to browse through for ideas or have older students research wildlife in your area and habitat requirements. Bring in books on garden seating, water or fountains, or on native plants and animals. Many gardening books, even those geared to adults, have beautiful color photos. Have students browse through the provided books and magazines before getting started. Students may first want to make drawings of the habitat. Then, supply a large variety of art materials so students can make colorful, detailed 3-D models of their dream habitats.

At this 'dreaming' stage it is not so important that the designs be to scale. Visiting the site with your class right before they begin will help remind/ inform them of the basic dimensions with which they are working.

3. Sharing Our Dreams

In this "sharing" component, students will have the opportunity to share their ideas orally with classmates, in written form with the Habitat Team and visually with the wider school community.

4. Once models are completed, have students give short presentations, noting important or special features of their habitat to their classmates. Remind students of the qualities of a strong presentation (i.e. eye contact, speaking slowly, etc.). During each report, have classmates fill out the peer assessment forms (a sample is provided on page 41) to ensure active listening. Educators or students should keep track of the features and components that appear most often in the dream habitats. After presentations, guide students to decide on the most appealing and critical elements that will need to be included.

5. Students should now prepare to compile the most popular features included in student dream habitat designs. For example, if the majority of the class chose to include a birdbath in the design, this may be something that should be included in the actual site design. Discuss with class until they come to a consensus on the elements and features from dream habitats that should be included in the site design. Have students refer back to their original Vision worksheets and compare their original thoughts to their current ideas. How much of the original vision is still there? What has changed, if anything?

Example:
Total students in Mrs. Smith's class: 25
Numbers of Students in Mrs. Smith's Class Whose Dream Habitats Included:

	#	%
Birdbath:	20	80
Stone bench:	7	28
Butterfly garden:	12	48

6. Have students write down the priorities and present them to the Habitat Team. Students should brainstorm on the best means through which to clearly communicate this data. The class may, for instance, choose to graph their results to make them easier for the Habitat team to digest (and allow students to practice math skills).

7. Publicly displaying the visual models produced by students and others is an excellent way to build school-wide interest and support for the project. This is not just a creative exercise, but a way for the whole community – students and adults – to give their input and ideas, realistic and fantastic, about the site. A display also provides a way for the Habitat team and the whole community to view each other's ideas – consider scheduling a Dream Habitat Show to coincide with a Back-to-School night or other school community event.

8. Ask students to create explanatory tags to accompany their models during the show. They may fill out a "My Dream Habitat" sheet (sample provided on page 42) or create another tag format. Explain to students that the tags are comparable to tags placed next to paintings in a museum – they are a chance for students to interpret their models for viewers. In addition, the tags will help draw attention to the special or critical features included in the dream habitat.

Peer Assessment Form

Peer Assessment Form

Name

Presenter's Name

Comments on Your Presentation

My Favorite Thing About Your Dream Habitat

One Question I Have For You About Your Dream Habitat

Peer Assessment Form

Name

Presenter's Name

Comments on Your Presentation

My Favorite Thing About Your Dream Habitat

One Question I Have For You About Your Dream Habitat

Peer Assessment Form

Name

Presenter's Name

Comments on Your Presentation

My Favorite Thing About Your Dream Habitat

One Question I Have For You About Your Dream Habitat

Worksheet

My Dream Habitat

National Wildlife Federation

Name _____

In my model, this is how I provided for:

FOOD

WATER

COVER

PLACES TO RAISE YOUNG

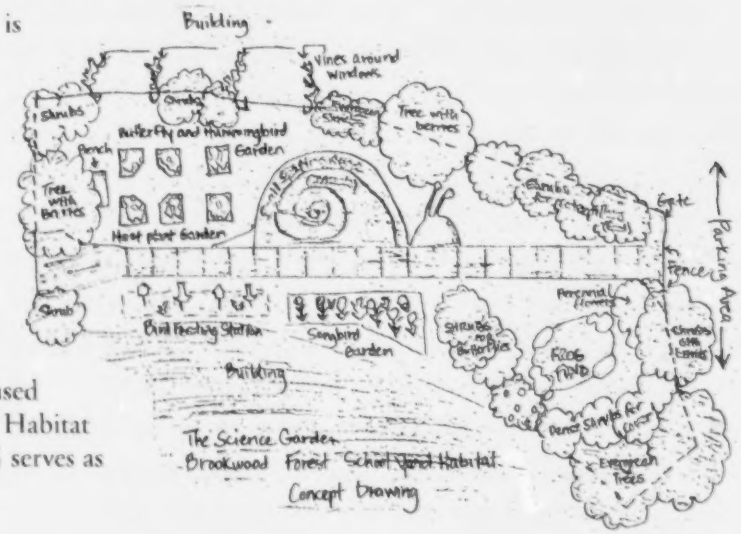
Other special features of my dream habitat:

© Copyright 2001 National Wildlife Federation

Defining Your Schoolyard Habitats Project

The Habitat Team will need to take student and community ideas into consideration when developing a final design plan for the site. Actual planting and construction of all habitat features at these sites may represent three to five years of effort by the school communities involved.

Remember a professional site map is not necessary. Each site will have different assets and constraints and will result in a unique combination of elements that are suitable for your particular schoolyard.



Selecting the Materials

Once the design is agreed upon, the team will need to focus on materials, especially plants, to be used in the creation of the habitat. The Habitat Plant Selection activity on page 44 serves as a guide in this process.

Involve students in real research needed to make thoughtful decisions about the Schoolyard Habitats site. Involving students in selection of the materials to be used in the habitat presents a great educational opportunity. The following activity focuses on a student-driven plant selection process. However, this concept could be extended to investigating materials for benches, water sources or other features. Educators may want to divide the tasks included in plant selection among different groups, classes or grades within the school. For example, 3rd graders could be responsible for making official recommendations for plantings to attract butterflies to the site, while 4th graders could recommend native tree species to include.

Students may simply send their recommendations for trees or butterfly garden plants to the Habitat Team in writing. Or, ask students to prepare formal presentations for the Habitat Team (a good opportunity for students to practice their oral presentation and public speaking skills). There are many ways of approaching the process, but developing student expertise in specific habitat features can never happen too early.

BEST COPY AVAILABLE

Activity 5
Habitat Plant Selection

National Wildlife Federation

Summary

Students will research and recommend native plants and trees to include in the design of the habitat site.

Grade Level: *3-8; K-2*

Time:
2 class periods (90 minutes) (This activity could be done as a research project for older participants, lasting several weeks).

Subjects: *Science, Geography, Art, Language Arts*

Skills: *Research, analysis, description, evaluation, synthesis*

Learning Objectives:
Students will be able to:

- *Define native and exotic plants.*
- *Identify at least three benefits to planting native species.*
- *Apply their knowledge of plants and plant-animal interactions to the selection of plantings for the Schoolyard Habitats project.*

Materials:
- *Region-specific field guides to plants, insects and animals*
- *Native plant guides*
- *Native plant seed catalogs*
- *Copies of Plant Selection Worksheet*
- *Pencils*

Background

When selecting plants for the site, choose plants native to your specific region. Native plants best meet the food and cover needs of local wildlife, and will help to support biological diversity on the local level. Selecting native plants is not only beneficial to wildlife and the environment, but to the gardener as well. Native plants require less work to maintain, including less water, fertilizer and pest control, leaving more time to observe and enjoy the natural space. Exotic plants are plants that have been imported from a different region (exotics in the U.S. often come from Asia or Europe). Frequently, these plants do not thrive in their new landscapes without increased use of resources, either natural (e.g., water) or synthetic (e.g., synthetic fertilizers and pesticides). In general, exotic plants are unable to sustain a wide variety of wildlife. They also can be invasive, which means that they reproduce rampantly and replace native (sometimes endangered) species.

Whenever possible, include plants that will: (1) provide nectar, seeds, pollen, fruit (2) increase insect numbers to provide the greatest variety of food sources for wildlife, and (3) provide year-round food sources. Remind students that the greater the variety of species planted in a habitat site, the greater variety of animals attracted.

For native plant resources and supply sources, look in the Resources section (page 66) or on the NWF website www.nwf.org/

Procedure

1. Reinforce the benefits of selecting a variety of plants for the Schoolyard Habitats site. Define and discuss the benefits of using native plants, both for the environment and the gardener. Explain that exotic (or non-native) plants often disrupt the balance of a local ecosystem.

2. For students who are able, this project should be research-oriented. Introduce students to the concept of a climate zone using a U.S. zone map (available from seed companies and nurseries). Ask students to identify the zone they live in and other regions with similar climactic conditions.

3. Have students review the data from the Site Inventory activity to have a clear idea of the physical environment of the site. What was the level of sunlight, the type of soil and the moisture conditions at the site? They will need this information to select appropriate plants. (If your class did not participate in that activity, they should solicit findings from the Habitat Team or another involved class, and familiarize themselves with it before starting the plant selection process.)

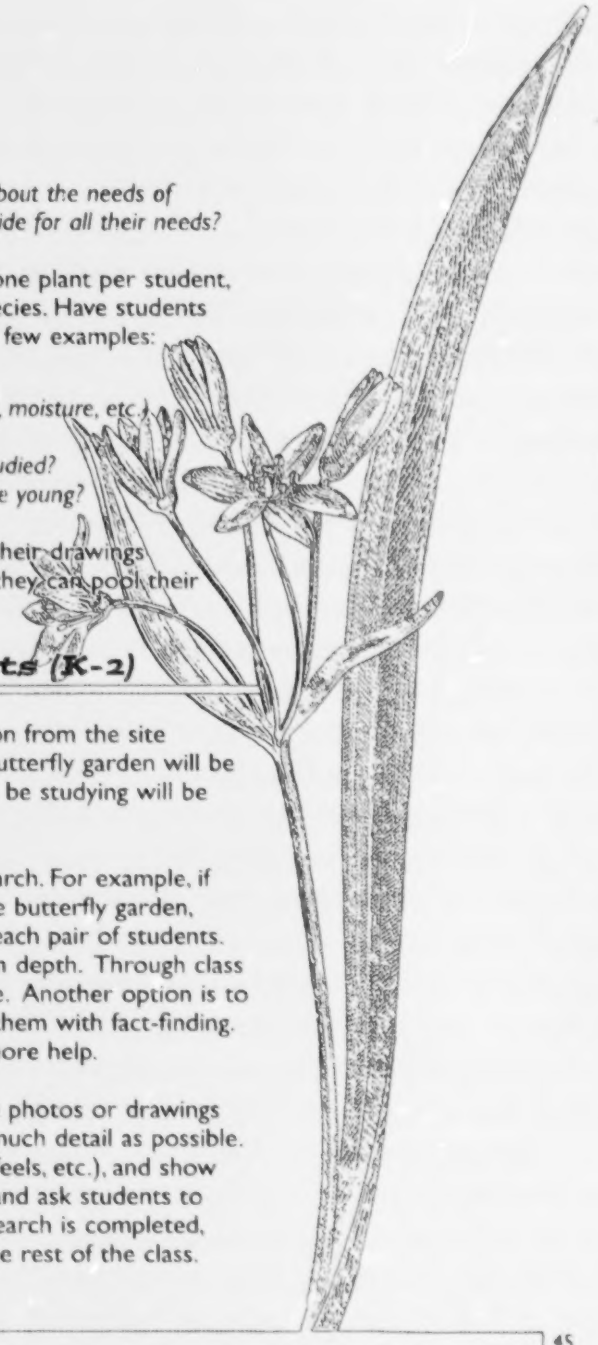
4. Encourage participants to select a variety of plants (e.g., different heights, foods produced, etc.) to enrich site diversity. Have field guides and other resources available for reference. If possible, have a list of recommended plants for the region and/or region-specific field guides available to help participants narrow their search. Features to consider in selecting plants:

- *Color*
- *Your climate zone*
- *Height*
- *Sunlight requirements*
- *Moisture requirements*
- *What will this plant offer to wildlife?*
- *Is the plant native?*
- *Which animals will the plants attract? Students learned about the needs of specific animals in prior activities. How can they now provide for all their needs?*

5. At some point, the species list should be limited to one plant per student, so each student can do deeper research on a specific species. Have students generate a list of questions to answer about the plant. A few examples:

- *Where does the plant grow?*
- *What does it need to be healthy? (e.g. how much sunlight, moisture, etc.)*
- *Is the plant used by humans for anything?*
- *What is the most interesting thing about the plant you studied?*
- *Do any animals use it for food, cover or as a place to raise young?*

6. At the end of their research, have students present their drawings and findings to their classmates. Once reports are done they can pool their information on a chart (as shown on following page).



Modifications for Younger Students (K-2)

1. For younger students, summarize relevant information from the site inventory for them (i.e., because the corner where the butterfly garden will be located is an area that gets no shade, all the plants they'll be studying will be ones that require full sun).

2. Assign each pair of students a type of plant to research. For example, if students are responsible for recommending plants for the butterfly garden, provide an example of one butterfly-attracting plant for each pair of students. During this activity, students will get to know one plant in depth. Through class presentations they will come to learn about several more. Another option is to have older students team up with younger pairs to help them with fact-finding. Otherwise pair stronger readers with those who need more help.

3. Ideally, obtain a sample of each of the plants or have photos or drawings readily available. Have students draw their plant with as much detail as possible. Have students describe their plant (how it looks, smells, feels, etc.), and show how it provides for wildlife. Provide reference materials and ask students to try to find a few more facts about their plants. Once research is completed, students should present their drawings and findings to the rest of the class.

Plant Selection Chart

National Wildlife Federation

Plant Name				
Wildlife Attracted				
Blooming Season				
Height				
Color				
Soil Type &Moisture Needs				
Sun Exposure				
Plant Name				
Wildlife Attracted				
Blooming Season				
Height				
Color				
Soil Type &Moisture Needs				
Sun Exposure				

© Copyright 2001 National Wildlife Federation

Project Planning

Once the class has chosen plants and other habitat elements, revisit the goals originally outlined. Assess the monetary, material and volunteer time needs of the plan. Look at the short-term and long-term goals that were outlined earlier and make changes as necessary, adding in more specific timelines. Delegate responsibilities within the team. Because habitat development is an ongoing and long-term process, periodic check-in meetings and effective communication are essential to success.

Reaching Out to the Community

In the next step, the team will focus on acquiring the needed materials by reaching out to the community. Many school groups have obtained in-kind donations and volunteer support to begin planting and construction.

Community assistance can come from a wide variety of sources: landscape architects ready for a new challenge; local businesses willing to donate plants, plant materials and expertise; garden and civic clubs excited to offer their knowledge, time and hands-on involvement. Ask parents and colleagues for their ideas about resources or local businesses that they think might be approachable. Arrange for a listing or an article in the local newspaper to help get the word out about the project and needs. Send out a press release. Another effective way to approach the community is through student letters. Local businesses and organizations often respond to student requests with enthusiasm. Time and effort are involved in locating these individuals or groups, but what they provide (material contributions, in-kind support, expertise and resources) are invaluable to the project. Efforts to secure financial, technical and other support from the larger community will be ongoing. It is important to remember that money does not need to be a limiting factor to the success of the project.

Fundraising Strategies

In-kind donations and volunteers are the lifeblood of a successful Schoolyard Habitats project. Yet, it may be necessary to secure monetary support as well. Local and federal public agencies may have grant programs to fund educational projects focusing on wildlife and habitat issues. Additionally, many private foundations and nonprofit organizations offer grants for such projects. Look at the listings of national and regional grants sources in the Resource section and on the Schoolyard Habitats website.

Schoolyard Habitats projects may also find support through a host of other creative fundraising ideas. Tried-and-true methods like car washes and bake sales can help raise funds. Other schools have been successful in appealing to the community to "adopt" a plant in their habitat site, or to buy engraved bricks or stones to be placed in a garden wall or used as stepping stones in the habitat area. Be creative – brainstorm with colleagues, parents, administrators and community organizations to help think of other options. Use the following budget planning worksheet to sketch out all items you need, estimate their costs, and potential sources of funds or donations.

Worksheet

Budget Planning

National Wildlife Federation

Items	Estimated Cost	Fundraising Strategy/Source	Point Person
Example:			
Plants	*$100*	*PTA funds*	*Mrs. Cooper*
Fencing	*$250*	*donation from Community Fencing Co.*	*Mr. Smith*

© Copyright 2001 National Wildlife Federation

Activity

Breaking New Ground

Summary:

Participants begin the project by clearing and preparing the ground.

Grade Level: 1-8

Time: 2 to 8 hours or more, dependent on size of habitat and number of participants.

Skills: Construction, application, problem-solving

Learning Objectives:
Participants will be able to:

- Demonstrate basic use of gardening tools.
- Utilize basic safety precautions.
- Use tools to prepare site for planting.

Materials: *Largely dependent on circumstances. (Note: Many companies manufacture child-sized gardening tools and gloves. Selecting appropriate tools will help with successful student involvement.)*
Some examples include:

- A flat-bladed, sharp shovel, for cutting sod, prying soil, or removing plants.
- A pointed shovel.
- Gardening gloves.
- A hand mattock (looks a little like a small tomahawk), for cutting roots.
- A wheelbarrow and buckets, to move plants, soil, or tools.
- Pruning shears, to cut vines, branches, or saplings.
- A tree saw (curved blade) for larger work.
- Stakes (and a mallet), string/rope, logs, or some system to mark off the area.
- Pitchfork or hoe, to loosen the soil.

Background

Breaking new ground will mean different things to different people. A group planting a habitat at the edge of a woods may decide to remove a few of the more aggressive shrubs and/or exotic plants, loosen the soil in selected spots and plant there. Some groups in more urban areas may have gotten permission to tear up asphalt, or they may have decided to build raised beds. A team enhancing a wetland area would need to keep soil disturbance to a minimum. Once the group has assessed the steps involved in prepping their site, the digging, loosening, pruning, and rock removal may commence.

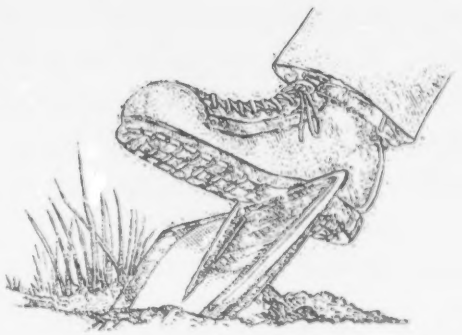
More often than not, "new ground" will include a portion of lawn, often a tough mat of shallow-rooted, flat-bladed grass. It is important as a first step to remove this non-native, aggressive grass from the site. Aggressive plants that were introduced from another region are called invasive exotics. These exotics will crowd out native plant species and greatly reduce the diversity of plant and animal life in the area. See the background section of the Plant Selection Activity, in the previous section, for more information about invasive exotics.

Since the method of preparing a site is so variable for each site, the information included here is very general. Resources specific to a particular type of site and methods of site preparation might include regional gardening books, websites, a local expert, or a local garden center. Also see Appendix #3 for information on container/rooftop gardens

Procedure

1. The group should first assess what sort of preparations they need to make for the site, e.g., debris removal, asphalt breaking, creating raised beds, etc. A detailed site map will provide clues, as will a well thought-out design.

2. Have the group select appropriate tools. Explain, and demonstrate the proper use of each of the tools. For example, participants using a flat-bladed shovel should only use it to cut into soil and pry, they should keep hands and feet away from the blade, and they should always keep the blade end below knee level. Break into small groups and have students practice using tools. If possible, assign a volunteer or older student to assist each group. To prevent injury, it is important to review proper lifting techniques. Have participants practice lifting with their legs, knees bent and back straight.



NOTE: *This is not a comprehensive set of safety precautions. Compile a set of safety precautions by contacting the tool's retailer, manufacturer, or other reliable source. Make sure to read all pertinent labels.*

3. Assign specific jobs and areas for each participant and explain each job as it comes up. Some of the major job descriptions follow.

4. Mark off the site. If the plan includes loosening a good deal of soil, take preventative measures so that a lot does not wash away. An erosion prevention device might be as simple as lining the plot with 3"-5"-diameter logs and staking the logs in place.

5. Remove plants that will negatively impact the site, especially aggressive, fast-growing exotics. Leave native plants; if they are in the pathway of your project, dig up and transplant to another area. Watch carefully for poison ivy, poison oak, poison sumac, thorny plants, and stinging nettles, (If these plants grow in your area, and no one in the group knows how to identify them, consult a field guide or a local expert). The removal process will vary for different types of plants.

6. Since it is such a common and usually daunting task, here are some options for lawn grass removal:

- One option is to lay down cardboard on the plot, and cover the cardboard with at least 6 inches of leaf mulch. This not only kills the grass; it makes for good, rich soil. Starting this process in the fall gives the cardboard and mulch time to degrade. Planting should begin only after the cardboard has degraded enough for roots to maneuver through. This could take several months, so it is best to start in the fall for spring plantings.

- Another way to kill the grass is to put a big piece of green or clear plastic over the plot and let it bake in the sun. If this is done in mid summer, the grass is relatively short, and the plastic stays intact, it may take as little as two to three weeks. It may take a few months at other times of the year. It should be done when grass is actively growing (i.e., lawn mowing season).

- Some people choose herbicides when working with very large plots of lawn grass. Only licensed professionals should handle herbicides. They are aware of safety issues, know what time of year to apply them, and know how much they need to apply. If this is the only option, do some research and recommend herbicides that biodegrade quickly and do not stay in the system for a long time. Otherwise herbicides can kill other plants, leach into and poison the ground water, or run off into streams and do much more damage than was intended. They may have effects on children as well. Herbicides should only be considered in cases where all other options do not work.

- A sod-cutter will cut the sod into strips, which can be rolled up, removed and saved for compost. An experienced adult should run this machine. Sod-cutters are available for rent at local equipment rental centers.

- A group with a small plot and a lot of muscle power can cut and pry out sod with a sharp, flat-bladed shovel. Cut small squares, about 1 1/2 inches deep, and pry out the pieces of sod. Set the squares aside and use them later for compost. Note, however, that lawn grass is hardy stuff; it will grow back (even upside-down!) given the chance. A few weeks under a plastic tarp in warm weather should kill it and make decent compost.

7. Once sod and any invasive plants are removed, where necessary cut roots and break apart tough soil with a hand mattock. Generally, it is not necessary to totally till the soil. In most areas the plants will do fine if the soil is loosened enough for roots to spread. The depth of soil to loosen depends on the needs of different plants.

8. Pull out medium-sized rocks, and set them aside. A rock pile on the site can provide shelter for beneficial insects, toads, chipmunks, etc. Leave small and really big rocks. The small ones will not hurt anything, but attempting to move the really big ones might hurt the mover. Removing a large rock will also leave a big, hard-to-fill cavity in the ground.

9. When the soil is ready, it is time to start planting!

Note: *Have water, sunscreen, and a first aid kit available. Take appropriate rest breaks.*

Activity 5

Planting Your Schoolyard Habitat Site

National Wildlife Federation

Summary:

Participants plant their selected vegetation on the habitat site.

Grade Level: K-8

Time: 2 to 6 hours or more, depending on size of habitat and number of participants.

Skills: Application, construction, problem-solving

Learning Objectives:
Participants will be able to:

- Demonstrate basic proper planting techniques and requirements.
- Place appropriate plants in their new habitat site, according to their site plan

Materials:
- Gardening gloves
- Shovels
- Rakes
- Hand trowels
- Water source (hose, watering can, etc.)
- Buckets
- Plants (i.e., trees, flowers, shrubs, seeds, etc.)
- Tree protectors (if planting seedlings)
- Mulch
- Compost or other organic material
- Plant markers and a permanent marker

Background

After weeks of researching, planning, and preparing it is now time for the real fun - planting the habitat! Participants will be thrilled to see their plans become an actual wildlife habitat. (You may want to create a school-wide planting day, or choose a weekend so parents and community members can participate).

While there are general planting guidelines to follow, each plant is unique. Most plants, seeds, and bulbs come with suggested planting depths and spacing measurements, as well as sun and soil requirements. If this information is not provided, ask the nursery staff for planting suggestions. When planting, keep in mind the size of each plant at maturity. At the same time, it is important to remember that things grow closer in nature and often grow in clusters, so do not be afraid to group plants together to form tight-knit communities. If large gaps are left between plants, nature will fill them in, often with unwanted invasives that can take over the habitat. Spacing decisions should be made prior to the day of planting.

Procedure

1. Gather all required equipment. Plants should be purchased ahead of time. If possible, take students on a field trip to a nursery to purchase the plants. The site should already be prepped; see previous activity for complete details.

2. Review the site design plan for the habitat with the group, including what plants go where. Go over general planting instructions (e.g., hole size, watering, mulching, etc.). Consider planting a shrub or plant as a demonstration. Review tool and safety issues as needed.

3. Divide participants into groups, assigning each group a certain area of the habitat to plant. If possible, assign a volunteer to assist each group. Give the participants area/plant specific instructions including how far apart plants should be spaced.

4. Begin planting. Remember, enthusiasm is contagious, so have a great time digging in the dirt!

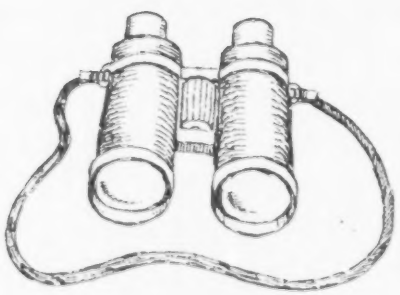
5. Have participants label plant markers (available at nurseries and garden centers) in permanent ink. Place in appropriate spots throughout the habitat to identify plants and educate visitors. Following the site design plan, have participants place additional elements in the habitat (e.g., benches, birdfeeders, etc.).

Note: Have water, sunscreen, and a first aid kit available. Take appropriate rest breaks.

Planting Guidelines

Plants and Shrubs:
Dig a hole the same depth and slightly wider than the container the plant came in. Remove the plant from its container and gently loosen the roots. Place in the hole and cover with backfill (soil from the hole). Gently pat down the soil to be sure there are no large air pockets, water, and apply mulch.

Trees:
Dig a hole twice as wide and no deeper than the container the tree came in or the height of its rootball. Remove the tree from its container or burlap wrap. Gently loosen the roots and place in the hole. Water for several minutes. Fill in the hole with backfill, pat down the soil and apply mulch. Be careful not to pile mulch around the tree trunk, as this traps heat and moisture and can cause the bark to rot. Use a tree protector (available at nurseries or through gardening catalogs) when planting seedlings. This will protect small trees from errant lawn mowers and hungry deer.



Bulbs and Seeds:
Refer to planting directions on packaging, water, and mulch. If desired, start seeds several weeks in advance as an additional activity for participants.

Soil:
If the soil is in poor condition in the area, mix some organic material such as compost in with the backfill. Be sure to match plant needs with soil conditions. Adding soil amendments can slightly alter the soil quality, but the basic needs of a plant must be met by the existing soil for the plant to thrive.

Watering:
Apply water generously, making sure to reach the roots and not just the surface. After the initial planting, water approximately once a week with 1 inch of water, although amount will vary with weather conditions and soil type. If possible, water with a soaker hose or other drip irrigation system. Native plants will require watering periodically for a full growing season to help them become fully established. Once established, they should not require watering except in times of extreme drought.

Mulching:
Apply at least a one-inch layer of mulch to the soil surface. There are a variety of mulches available including wood chip, leaf, and pine needle. Use what is readily available and fits the project budget. Not only does mulch look attractive, it helps hold in moisture, adds nutrients, and helps cut down on weed growth.

Maintenance

Creating a habitat-based learning site at school lessens the need for traditional maintenance of the area. Nonetheless, some work is required, particularly in the beginning, to maintain the site. Most programs, once started, find plenty of willing supporters interested in volunteering time for maintenance. Usually, students do most maintenance throughout the school year. If sharing the responsibilities with other classes, make a work schedule for each semester.

However, you still need to plan for the watering, weeding and general upkeep of the habitat site over the summer months and other holidays when fewer students are at the school. Contact summer school teachers to see if they are interested in incorporating the habitat site into the summer program. Their students can enjoy and maintain the site during the summer months. Alternatively, different teams of students and parents or neighbors can sign up to take care of the habitat for a specific week of the summer. Attention to maintenance issues is an extremely important aspect of creating a Schoolyard Habitats site – it ensures that students can return to school in the fall to continue the enjoyment and learning opportunities of the habitat site. Even if students are not directly involved in summer maintenance, they can make their contribution to the longevity of the habitat by creating a care guide, as outlined in the following activity.

Activity

Creating a Field & Care Guide

National Wildlife Federation

Summary

Students create a guide to the habitat site that includes a map and instructions on maintaining the site.

Grade Level: *K-8*

Time: *2 to 5 class periods (time depends on the number of elements included in the guide and the number of participants contributing)*

Subjects: *Language Arts, Art, Science, Geography*

Skills: *Classification, description, generalization, research, synthesis*

Learning Objectives:
Students will be able to:

- *Write a guide to the plants and other features found in their Schoolyard Habitats sites*
- *Create guidelines for site maintenance*
- *Describe site features to future students and community members*

Materials:
- *White or colored paper*
- *Scissors*
- *Stapler*
- *Glue*
- *Pens, pencils, colored pencils, markers*
- *Regional field guides and other resources*
- *Care instructions that accompanied plants when purchased*
- *Pictures of plants, if available*
- *Field guides to local wildlife*
- *3-ring binder*

Note: *If the class has access to typewriters or computers, consider having them type the text and insert graphics into the document. Laminating the pages will make the guide last longer. In any case, bind the final product in a 3-ring binder so that additions and changes will be easy to make over time.*

Background

Creating a field and care guide for their Schoolyard Habitats site is a great way for students to apply all that they have learned, while creating a useful, educational tool for others. The guide can be used as a learning resource for other classes, school visitors, parents and community members who want to take group or self-guided walks through the site.

This field guide will also include instructions on how to care for the Schoolyard Habitats site. During the school year, many students can participate in the maintenance and care of the site. The maintenance section will help streamline procedures and help during holidays and summer when people unfamiliar with the site may be helping out. In this activity, all students involved in the project will pool their knowledge to ensure the stewardship of the site.

In addition to providing detailed instructions about caring for the wildlife habitat site, participants may want to add creative pieces to the guide, such as artwork, poetry, photos of plants, wildlife and the site (before and after), a special note to caretakers, and a dedication page.

This guide can also serve as a culminating assessment for student understanding of their habitat project.

Procedure

1. Divide the class into groups, or divide the work between various classes in school. Each group or class will produce one section.

Sections should include:

◆ ***Habitat Map***

Ask students to draw a map of the Schoolyard Habitats site that someone else could use to locate specific features. For older students, this is an opportunity to teach students to map to scale; for younger students emphasize the importance of details in the maps. Students may want to color code or create a key for their maps, clearly indicating pathways, types of gardens, locations of birdfeeders, maintenance supplies and entrance.

◆ ***Plant List and Care Instructions***

Much of this work will have been done during the plant selection activity, but have students organize and expand the plant information. For each tree, plant or flower in the habitat, groups should create one or two pages. Include plant names (common and scientific), pictures (can include photos, drawing, dried leaf, leaf rubbing, etc.), description (can include height, spread, type of leaves, flower color, plant uses, how it benefits wildlife, etc.), and plant care and growth requirements (soil, light, moisture and pruning needs).

◆ ***Special Features***
This section can include descriptions of features other than plantings that have been included in the Schoolyard Habitats site. This is where students can describe the purpose and success of ponds, bird feeders, compost bins and any other unique features.

◆ ***Wildlife Sightings***
This section may require setting aside time for first-hand observations. Alternatively, create a journal that all habitat visitors can use to record what kinds of wildlife they saw at the site. Students may also want to poll other students in the school for a list of all wildlife seen at the site. A small amount of information, such as hints on where to look for the animal will help visitors trying to locate wildlife.

◆ ***General Habitat Maintenance***
Students should compile descriptions of the general Schoolyard Habitats maintenance needs, including how often these tasks must be done and any special equipment needed. For example, students may need to write down how often they refill a birdbath and how often they must clean it.

◆ ***Seasonal Habitat Maintenance***
In this section include maintenance tips for different seasons. In winter, feeders may need to be filled more often. In summer, water supplies might need to be replaced daily instead of twice a week.

◆ ***Cover Design, Artwork and Acknowledgments***
The cover and artwork pages (which may be interspersed throughout the guide) are ideal places to feature student creativity. Consider leaf prints, painting with berries from the garden or using dried flowers in a collage. To highlight how the site has impacted students personally, they may want to add short creative writing pieces or poetry written about the site. The acknowledgment page should include the names of all those who helped create the Schoolyard Habitats site, as well as all of those who donated time or materials to the project. You may want to include a photograph of the students and other members of the Habitat Team.

2. Once sections are complete, put into a 3-ring binder. To ensure the only copy you have is not destroyed, make color copies and/or laminate the pages. You may want to store a copy in a "visitor's box" near the site, and keep another in the school lobby, office or library.

3. Tell other teachers and community members where the notebook is kept (preferably in an area that others can access). Add new pages as they are created, and the site develops over time.

The time and effort the **Curriculum Committee** dedicates to making the connection between school curriculum and the Schoolyard Habitats project is just as critical as that invested in the planning and creation of the habitat site itself. The purposes of NWF's Schoolyard Habitats Program are to build: 1) awareness of habitats (by instilling in students a sense of wonder and discovery), 2) knowledge of how habitats work and why they are important, 3)habitat investigation skills, and 4) skills and knowledge required to protect and restore habitats through action projects, specifically focusing on creating Schoolyard Habitats sites.

Schoolyard Habitats projects are excellent action projects because they result in increased:
1) ecological literacy
2) questioning and analysis skills
3) use of effective teaching methodologies
4) links to the local community
5) student decision-making and acceptance of personal responsibility
6) exploration of strategies for taking action, development of skills needed to do so
7) healthy wildlife habitat

Habitat sites offer a plethora of teaching and learning opportunities, not only for skill-building, but also for content exploration in all disciplines, including science, math, language arts/English, social studies and art. This curriculum connection is vital to the longevity of the Schoolyard Habitats project as it makes it easy for teachers to use the site regularly and incorporate it into year-round lessons.

The **Curriculum Committee** can take the lead by sharing with all faculty what they have learned about using the site through their own research and planning, either at meetings, through a newsletter or in informal lunchtime workshops. They will benefit from facilitating brainstorming sessions among colleagues, which multiplies the Schoolyard Habitats cross-curricula connections. Arranging a talk by an educator from a school with a certified Schoolyard Habitats site who has already successfully incorporated the site into their lessons, or an NWF field educator can provide guidance and inspiration. The team should stress that using the habitat site is not another thing being added to their already full curricular plates; instead the habitat should be seen as a tool with which to more effectively teach and convey the concepts

already on their agenda! Encourage teacher shadowing, so that a teacher confident teaching in the habitat can model a lesson for a more hesitant colleague.

Below is a very small sampling of the types of activities that teachers have led in their Schoolyard Habitat sites. Further help in making the habitat connection can be found in many quality curricula series, as well as on various Websites. (See Schoolyard Habitats Resources.)

Mathematics

- ◇ Measure/calculate plant growth rates and flower numbers
- ◇ Calculate the area of the habitat
- ◇ Estimate the canopy area of a tree
- ◇ Calculate cost savings from reduced maintenance of the land used as a habitat area

Social Studies

- ◇ Research past land use of the school site
- ◇ Study local Native American culture and the use of native plants as foods and medicinal herbs
- ◇ Follow local/state/national conservation policy and decision-making processes regarding wildlife conservation issues
- ◇ Establish and maintain food and herb plots

Art

- ◇ Make leaf prints
- ◇ Use plant materials for dyes and paints
- ◇ Study wildlife art and photography
- ◇ Sketch flora and fauna create personal field guides
- ◇ Create stepping stones to be laid in the habitat site
- ◇ Create statues for display in the habitat

Science

- ◇ Study ecological concepts and biological processes such as plant distribution (native vs. non-native), food webs, and photosynthesis
- ◇ Learn about regional weather patterns affecting habitat
- ◇ Investigate microclimates influencing the animals and plants in the site
- ◇ Learn about the lifecycles of native plants and wildlife

Music

- Create musical instruments from natural items (acorn caps, grass blades, etc.)
- Listen to the sounds of nature and make seasonal recordings of the habitat sounds
- Listen to and discuss songs and other musical forms that reflect the natural world

Language Arts

- Read and analyze natural history writings from the region
- Involve students in keeping nature journals
- Write and perform a play based on student experiences and observations of wildlife in the habitat
- Illustrate language concepts and forms with examples and exercises based on habitat experiences (haiku, onomatopoeia)
- Practice writing skills through exercises related to habitat development (i.e. thank you letters, invitations, project newsletters, fundraising efforts, grant writing projects, radio and television scripts and public service announcements.

These suggestions give a few ideas of the many cross-curricular opportunities a Schoolyard Habitats project offers educators and students. Let student and educator imagination and creativity run wild! Watch the positive changes in students as they begin to learn from and in the habitat.

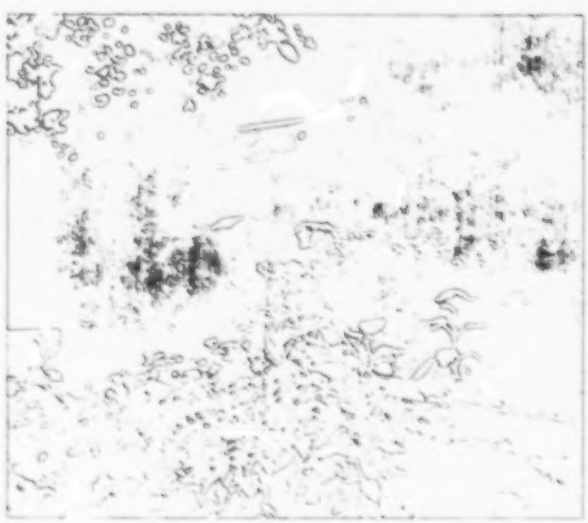
Schoolyard Habitats® Certification

Once your group has developed and implemented your Schoolyard Habitats plan, certify the project as an official Schoolyard Habitats site by the National Wildlife Federation. School communities that have created a wildlife habitat-based learning site may apply for certification by completing the application form included in this guide.

Applications will be reviewed by Schoolyard Habitats staff to see that basic criteria have been met. It isn't necessary to achieve a full-grown habitat before seeking certification. In fact, the sooner you certify your site, the sooner you will be able to reap the benefits that will help you continue the process.

When your habitat is certified, you will be sent a Certificate of Achievement from the National Wildlife Federation. Your habitat will be assigned its own unique number and it will be entered in our computer-based National Registry of Schoolyard Habitats Sites. You will also receive the quarterly Habitats newsletter and information about how to stay active in the program. An announcement about your achievement will be sent by NWF to your local news media. This national recognition will help your efforts to raise funds in the future. You will also be able to join an online discussion group of Schoolyard Habitats practitioners, access NWF resources, information and expertise, and join a dynamic network of educators nationwide.

Certification is an important milestone in what we hope will be a long journey of teaching and learning in your Schoolyard Habitats site. Habitat work is a dynamic, on-going process. After certification, we encourage you to take advantage of the living laboratory you have created by incorporating the site into your school's curriculum and instruction. The National Wildlife Federation offers professional development workshops and curricula to support the use of Schoolyard Habitats sites as teaching tools. We also recommend that you look at some of the resources we have selected in the following section to help you in your ongoing work. Lastly, remember to tap into the rich resources of fellow educators involved in habitat work – participate in our Schoolyard Habitats Practitioner's listserv, develop partnerships with local organizations, and network with other certified sites in your region. Together, we can strengthen and support our important efforts to create and restore wildlife habitat and to use wildlife habitat as an effective teaching tool.



Thank you for your interest and participation!

schoolyard habitats® Application for Certification

School/Learning Center Name _____

Principal/Director _____

Contact Name (if different) _____

Address _____

City _____

State/Province _____ County _____ Zip/Postal Code _____

School Telephone _____ Contact Telephone (if different) _____

Fax _____ Contact E-mail Address _____

Office Use:
Habitat # _____
Date Received _____
Certified _____
C.S. _____
Key Words _____
Source Code _____

Would you like to be added to the Schoolyard Habitats listserv? ☐ *Yes* ☐ *No*

School Website Address _____ *Does your website feature your SYH project?* ☐ *Yes* ☐ *No*

Would you like your Schoolyard Habitats site featured on the NWF website? ☐ *Yes* ☐ *No*

Grade Level(s) Served by School/Learning Center: _____

Ages of Students Actively Involved in SYH Project: _____

Size (Sq. Ft. or Acres) of SYH Project Site: _____

How did you hear about the Schoolyard Habitats program? _____

A Schoolyard Habitats project can be an incredible addition to your school campus and local community for many years to come. After reading the Schoolyard Habitats Planning Guide, please complete all five sections of this application, showing the steps you have taken to create the habitat area and how it is used as a learning site. Incomplete applications may not be accepted. For assistance with the application, contact the SYH Program Staff at wildlife@nwf.org or call 1-800-822-9919.

I) Project Description/Goals

Please briefly describe current projects and future goals for the Schoolyard Habitats site. Include the process that occurred during the development of your habitat and the educational objectives of this project

_____

_____

_____

_____

_____

_____

177

II) Habitat Team Structure

The team should represent a variety of people (i.e. not all team members should be teachers). List the key participants involved with the habitat project and the segment of the school community they represent.

Team Member Name:	Representing:

III) Habitat Components

Locally native plants provide the widest range of seasonal habitat benefits to wildlife. If we want not only to attract wildlife, but to help restore the diversity of our local ecosystems, we must bring back our locally native plants. The National Wildlife Federation strongly encourages the use of native plants.

A. FOOD: *Plantings and Feeders*

Food is best provided for wildlife naturally (nuts, nectar, berries, pollen, and buds). The best source of naturally occurring food is found in plants native to your region. Care should also be taken to provide year-round food sources for local wildlife. Briefly list the food available for wildlife at your site, if it is provided naturally or as a supplement, and if it is provided through native plants. Discovering which plants are native is an important part of the learning process in Schoolyard Habitats work. If you are unsure whether the plants on your schoolyard are native, involve your students and Habitat Team in research to find out!

Food Type:	Provided By:	Visited By:	This plant is native: Yes	No
ex. berries	*Cotoneaster*	*Hermit Thrushes, Robins, & Bluebirds*	☒	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐

B. WATER: *Drinking, Bathing*

Wildlife needs water daily and throughout the year. An elevated birdbath may protect birds from cats and other predators, while a shallow, wide-rimmed dish will provide water for small animals when placed on the ground near shrubbery or other cover. A small pond set into the ground can provide not only water for drinking and bathing, but cover and reproductive areas for small fish, frogs, insects and reptiles.

We provide water: ☐ Throughout the Year ☐ Seasonally

We provide water in: ☐ Bird Bath ☐ Pond
☐ Spring ☐ Water Garden
☐ Water Dripping into a Bird Bath ☐ Stream
☐ Other (describe): _____

C. COVER: *Places to Hide*

The ideal wildlife habitat area will include plants ranging in size and density from evergreen ground cover to tall, mature trees. This variety of plant life will assist a range of animals in selecting the appropriate cover they need for feeding, hiding, courting and nesting. Hollow logs, brush piles, and stone walls can add to the range of cover you provide.

We provide cover for wildlife in the following manner:

Deciduous Shrubs/Trees:	Number	Evergreen Shrubs/Trees:	Number:

☐ Brush Piles ☐ Log Piles ☐ Rock Piles/Walls ☐ Ground Covers

☐ Meadow, Scrub, or Prairie Patch ☐ Other (describe): _____

D. PLACES TO RAISE YOUNG

A more specific kind of cover is needed to make your wildlife habitat complete. These are areas for courtship and for nurturing young animals and include safe areas for nests, specific plants upon which butterfly caterpillars depend, and the shallow water security that tadpoles find in a pond.

We provide the following for nesting birds, denning mammals, egg-laying reptiles and amphibians, fish, butterflies, and other insects and invertebrates:

Large Trees:	Small Trees:	Shrub Masses:

☐ Trees with Nest/Den Cavities ☐ Dens in Ground/Rock

☐ Water Garden/Pond ☐ Nesting Boxes

☐ Nesting Shelves ☐ Meadow, Prairie, or Scrub Patch

☐ Other (describe): _____

IV) Site Diagram and Project Documentation

Please enclose a sketch or landscape design on 8.5" x 11" paper to visually explain the components of your Schoolyard Habitats site. Please make note of which elements are currently in place, and which will be added in the future. Indicate any features created to make the habitat accessible to students with disabilities (i.e. pathways, raised planting beds, etc.). We are unable to return all materials; please keep a duplicate copy for your records.

We encourage you to send before and after photos of your Schoolyard Habitats site, as well as photos which demonstrate student and community involvement with the project. Please label all photos with your school name, city, state, and approximate dates when the photos were taken. All photos must be accompanied by a release form. Please download a copy of the release form from our website (or contact our office to request a copy if you plan to include photos with your application). We are unable to return materials sent to us, so please be sure to keep duplicates for your records.

V) Widening the Classroom Walls: *Curriculum Use*

Please submit additional pages as needed.

A. Describe how you are using your Schoolyard Habitats site for cross-curriculum learning. How do you meet state/local benchmarks and standards of learning through use of your habitat site?

B. How many teachers at your school are currently using the Schoolyard Habitats site as an educational tool?

C. What steps have you taken or do you plan to take in order to increase the usage (by students and teachers) of your Schoolyard Habitats site?

D. Have educators at your school written up lessons or curriculum for use in the Schoolyard Habitats site or to accompany the project? Please describe.

E. What resources have been helpful in the planning and instructional use of your Schoolyard Habitats project (e.g., Project Wild, Project Learning Tree, NAAEE's VINE program)?

F. What other types of resources would be useful to the future development and use of your Schoolyard Habitats site?

VI) Maintenance

Briefly describe your maintenance plan, both during the school year, as well as during the summer months.

***Thank you* for your interest and participation in the Schoolyard Habitats Program.**
Please:

- Allow 6-8 weeks for processing of the application.
- Be sure to save copies of all materials you submit as they will not be returned.
- **Please submit this application with the $15 Program Enrollment Fee to cover our processing and handling costs.**
- If submitting photos, please enclose a photo release form (see IV. Site Diagram and Project Documentation).
- All submissions must be sent together in one 9" x 12" envelope.

Please send your submission to:

Schoolyard Habitats Program
National Wildlife Federation
11100 Wildlife Center Dr.
Reston, VA 20190-5362

NATIONAL WILDLIFE FEDERATION®
www.nwf.org™

Questions? Call us at 1-800-822-9919 or 703-438-6000 • World Wide Web http://www.nwf.org/habitats/schoolyard

printed with soy inks on recycled paper with 100% post-consumer waste

Schoolyard Habitats Resource Guide

National Wildlife Federation

The list below highlights helpful references for Schoolyard Habitats projects. In addition to this listing, resource listings — including books, newsletters, videos,World Wide Web Home Page addresses, resource agencies and organizations — are updated on a regular basis on the NWF Schoolyard Habitats website. Visit us at www.nwf.org for additional information.

NWF Resources

National Wildlife Federation's Schoolyard Habitats® Program
http://www.nwf.org/schoolyardhabitats
Information on creating a wildlife habitat on your school grounds, and certifying your habitat as an official Schoolyard Habitats site. Also offers professional development workshops on: Creating Schoolyard Habitats, Habitats, Wetlands, Water, Prairies, Northern Forests, Arctic, Endangered Species, Bears, and Smart Growth

Habitats
Free newsletter for certified Schoolyard Habitats published by the National Wildlife Federation. Showcases habitat projects and features articles and ideas relevant to both Schoolyard and Backyard Wildlife Habitats.

The National Wildlife Federation's Schoolyard Habitats® Listserv
The Schoolyard Habitats listserv allows individuals interested in the creation and use of habitats on school grounds to share ideas. Participants include environmental education experts, resource professionals, teachers, parents, and individuals interested in using the outdoors as a teaching tool. If you would like to be added to this list, send a blank email to syh-exchange-subscribe@igc.topica.com.

The National Wildlife Federation's Backyard Wildlife Habitat® Listserv
Topics discussed usually include tips for creating and maintaining habitats, interesting backyard wildlife sightings, questions relating to attracting wildlife, and much more. If you would like to be added to this list, send a blank email to bwh-exchange-subscribe@igc.topica.com.

National Wildlife Federation NatureScope Kits
Classroom resources helping educators introduce environmental issues. Available for the following topics: Habitats, Northern Forest, Smart Growth, Water, Wetlands, Wolves, Prairies, Endangered Species, Arctic, Bears.

National Wildlife Federation. **Ranger Rick.**
Monthly nature magazine for use by grades 4-6. To order: 1-800-611-1599.

National Wildlife Federation. **Ranger Rick's NatureScope.**
Designed to help K-8 educators incorporate science and environmental education into their teaching through creative activities. Titles include: Amazing Mammals, Part II, Astronomy Adventures, Birds, Birds, Birds, Digging into Dinosaurs, Discovering Deserts, Diving into Oceans, Endangered Species: Wild and Rare, Geology: the Active Earth, Incredible Insects, Let's Hear it for Herps, Pollution: Problems and Solu-

tions, Rain Forests: Tropical Treasures, Trees are Terrific, Wading into Wetlands, Wild About Weather, Wild and Crafty

National Wildlife Federation. **Your Big Backyard.**
Monthly nature magazine for use by grades K-3. To order: 1-800-611-1599.

Chedzoy, Sue. **Physical Education in the School Grounds.**
1993. Learning Through Landscapes
Provides outdoor activities for K-6 that go beyond typical PE curriculum.

Schoolyard/School Garden-Specific Curriculum

Dean, Jacqui. **History in the School Grounds.**
1993. Learning Through Landscapes.
Outdoor activities for K-6 that help students gain a better understanding of history and their school's past.

Hare, R., C. Attenborough, and T. Day. **Geography in the School Grounds.**
1993. Learning Through Landscapes.
Outdoor activities for K-6 focusing on geography skills, such as map making, the use of photographs and models, water and land forms, and environmental quality.

Jurenka, Nancy Allen. **Beyond the Bean Seed: Gardening Activities for Grades K-6.**
1996.
Hands-on activities which integrate gardening and language arts.

Keaney, Brian. **Arts in the School Grounds.**
1993. Learning Through Landscapes.
Numerous creative outdoor art, drama, design, music, and dance activities for K-6.

Keaney, Brian. **English in the School Grounds.**
1993. Learning Through Landscapes.
Activities for K-6 designed to teach students writing, reading, listening, and speaking.

Kiefer, Joseph and Martin Kemple. **Digging Deeper: Integrating Youth Gardens Into Schools & Communities.**
1998. Food Works and Common Roots Press.
Takes you step by step through the entire process of creating a garden for educational purposes on school grounds. While the focus of the book is vegetable gardens, the information and specific examples are applicable for any type of school garden project.

BEST COPY AVAILABLE

Life Lab. **The Growing Classroom: Garden-Based Science, Grades 2-6.**
1990. Life Lab: Santa Cruz, CA.
Resource for teaching math, reading, and nutrition skills. Provides experiments, fun games, and pictures that make learning fun.

Ocone, Lynn and Eve Pranis. **National Gardening Association Guide to Kids' Gardening.**
1990. John Wiley and Sons, Inc.
Information on how to start gardening projects with kids, including a section on garden activities.

Ocone, Lynn and Eve Pranis. **GrowLab: Activities for Growing Minds.**
1990. National Gardening Association.
Creative plant-related activities for grades K-8.

Rhydderch-Evans, Zoe. **Mathematics in the School Grounds.**
1993. Learning Through Landscapes.
Activities for K-6 divided into sections on numbers, measurement, space and shape, and data work.

Russell, Helen Ross. **Ten Minute Field Trips.**
1990. National Science Teachers Association.
Hands-on learning K-6 activities to do on school grounds with or without a school garden or wildlife habitat.

Sobel, David. **Mapmaking with Children: Sense of Place Education for the Elementary Years.**
1998. Heinemann Press.
Provides a developmental perspective on children's understanding of maps, and gives concrete examples of developmentally appropriate mapmaking activities for children ages 5-12. Activities foster students' development of a sense of place, beginning with their own yards and communities.

Thomas, Gill. **Science in the School Grounds.**
1993. Learning Through Landscapes.
Activities for K-6 focusing on ponds, trees, grassy areas, wildflowers, waste-management, mini-beasts, weather, and the built environment.

Magazines / Newsletters

Green Teacher
Fifty page quarterly magazine that provides environmental information and activities for educators of grades K-12. 916-960-1244 www.greenteacher.com/

Environmental Education Activities

Cornell, Joseph. **Journey to the Heart of Nature: A Guided Exploration.**
1995. Dawn Publications.

Cornell, Joseph. **Sharing Nature with Children.**
176p. 1998. Dawn Publications.
Provides activities and insight on ways to involve kids with the outside world.

Cornell, Joseph. **Sharing the Joy of Nature: Nature Activities for All Ages.** 1989. Dawn Publications.

Environment & Education. Habitat and Biodiversity: Teacher Resource Guide.
1998. Dale Seymour Publications.
Activities which use the school grounds as a research laboratory for grades K-12. Topics covered are biodiversity, landscape management, xeriscaping, composting, and integrated pest management.

Hogan, Kathleen. **EcoInquiry: A Guide to Ecological Learning Experiences for the Upper Elementary/Middle Grades.**
1994. Kendall Hunt.

Hunken, Jorie. **Ecology for All Ages: Discovering Nature Through Activities for Children and Adults.**
1994. Globe Pequot Press.

Lingelbach, Jenepher and Purcell, Lisa, eds. **Hands-On Nature: Information and Activities for Exploring the Environment with Children.**
2000. Vermont Institute of Natural Science.
Well organized and effective nature-based activities.

Parella, Deborah. **Project Seasons: Hand-on Activities for Discovering the Wonders of the World.**
Shelburne Farms.
Elementary activities focused on science through the seasons.

Roberts, Janet Weir and Carol Huelbig. **City Kids and City Critters: Activities for Urban Explorers.**
1996. Learning Tiger Press, McGraw Hill.

The American Forest Foundation. **Project Learning Tree: Environmental Education.**
1996. Pre K-8 Activity Guide.

Tilgner, Linda. **Let's Grow! 72 Gardening Adventures with Children.**
1988. Story Communications.

Council for Environmental Education. **Project WILD K-12 Activity Guide.**
2000.

WOW! The Wonders of Wetlands: An Educator's Guide.
1995.
Background information and 50 activities for grades K-12. Special appendix on creating a schoolyard wetland habitat.

Landscaping for Wildlife

California Center for Wildlife Staff. **Living With Wildlife.**
1994. Sierra Club Books.
Describes more than 100 North American wildlife species and their interactions with humans. Provides advice on how to care for wildlife in distress, prevent human-wildlife conflicts, and deal with problems in a humane manner.

Druse, Ken and Margaret Roach. **The Natural Habitat Garden.**
1994. Crown Publishing Group.
Information on how to create a beautiful, wildlife-friendly landscape using native plants. Covers many different types of ecosystems (grasslands, drylands, wetlands, woodlands, etc.) and has numerous full color pictures of the recommended plants.

Henderson, Carroll. **Landscaping for Wildlife.**
1994. Minnesota Dept. of Natural Resources.
Guide, reference, and resource book for creating natural landscaping that support wildlife.

Marinelli, Janet, ed. **The Environmental Gardener.**
1992. Brooklyn Botanic Garden, Inc.

Schneck, Marcus. **Your Backyard Wildlife Garden.**
1992. Rodale Press.

Stein, Sara. **Noah's Garden: Restoring the Ecology of Our Own Backyards.**
1993. Boston: Houghton Mifflin.
Inspiring story of the author's experience of transforming her conventional yard into a wildlife haven. Provides practical information on the way ecosystems works.

Wyzga, Marilyn C. **Homes for Wildlife: A Planning Guide for Habitat Enhancement on School Grounds.**
1998.
New Hampshire Fish and Game Department. Excellent step-by-step guide for creating a schoolyard wildlife habitat and integrating it into the curriculum. Geared toward K-8 teachers. Available through the Acorn Naturalist 1-800-422-8886

Inclusive Landscaping

Greenstein, Doreen. **Backyards and Butterflies: Ways to Include Children with Disabilities in Outdoor Activities.**
1993. New York State Rural Health and Safety Council.

Rothert, Gene. **Enabling Gardens: Creating Barrier-Free Gardens.**
1994. Dallas, TX: Taylor Publishing Company.
Information and techniques on how to make a garden accessible for individuals with mobile, visual and other impairments.

Landscaping for Children

Learning Through Landscapes. **The Challenge of the Urban School Site.**
1996.
Instruction and inspiration for creating successful outdoor learning areas at urban schools. Offers practical advice on multi-cultural issues, making use of limited space, seating, shelter, arts, vandalism, and removing asphalt.

Moore, Robin C. **Plants for Play: A Plant Selection Guide for Children's Outdoor Environments.**
1993. MIG Communications.
Offers suggestions on plants that have educational value and are safe for children.

Moore, Robin C. And Herb H. Wong. **Natural Learning: Creating Environments for Rediscovering Nature's Way of Teaching.**
1997. MIG Communications.
Uses a specific school as a case study to guide teachers, administrators, designers, and parents through naturalizing a schoolyard and integrating it into the curriculum.

Schiff, Paul and Dr. Cindi Smith-Walters. **WILD School Sites: A Guide to Preparing for Habitat Improvement Projects on School Grounds.**
1994. Project WILD.

Stine, Sharon. **Landscapes for Learning: Creating Outdoor Environments for Children and Youth.**
1997. John Wiley & Sons, Inc.
Provides useful information on what makes a schoolyard habitat successful using 11 case studies and numerous photos and drawings. Also outlines essential elements for any play environment.

Titman, Wendy. **Special Places, Special People: The Hidden Curriculum of School Grounds. 1994. Learning Through Landscapes.**

Wood, Joan and Michael Littlewood. **A Guide to the Management and Maintenance of School Grounds.**
1996. Learning Through Landscapes.

Native Plants

Beaubaire, Nancy, ed. **Native Perennials: North American Beauties.**
1996. Brooklyn Botanic Gardens, Inc.

Information on how to include native plants in your garden design and how care for them. Also provides lists of native wildflowers suppliers.

Marinelli, Janet, ed. **Going Native: Biodiversity in Our Own Backyards.** 1994. Brooklyn Botanic Gardens.
Suggests native plants to use in your landscape and the benefits of doing so

Sawyers, Claire, ed. **Gardening with Wildflowers and Native Plants.** 1990. Brooklyn Botanic Gardens.
Suggests native plants and wildflowers for an attractive wildlife-friendly landscape.

Wilson, William H. **Landscaping with Wildflowers and Native Plants.** 1985. Ortho Information Services.
Information on how to design and create prairies, meadows, alpine, and desert gardens. Also suggests where to find native plants and seeds.

Composting

Appelhof, Mary. **Worms Eat My Garbage: How To Set Up and Maintain a Worm Composting System.** 1982. Flowerfield Enterprises.

Martin, Deborah L. and Grace Gershuny, eds. **The Rodale Book of Composting.** 1992. Rodale Press.
Complete information on composting including: history, benefits, methods, equipment, and how-to information.

Soils

Bowles, John Paul, ed. **Soils.** 1990. Brooklyn Botanic Garden, Inc.
Information on the properties of soil, plant requirements for soil, how to test your soil, how to improve your soil, and much more.

Water Gardens

Burrell, C. Colston, ed. **The Natural Water Garden: Pools, Ponds, Marshes & Bogs for Backyards Everywhere.**

1997. Brooklyn Botanic Garden, Inc.
Helps you select the best type of water garden and plants for your site and region. Offers step-by-step instruction for designing, creating, and installing ponds, marshes, and bogs.

Pest Management

Olkowski, William, Sheila Daar, and Helga Olkowski. **Common-Sense Pest Control.**
1991. Taunto Press.
Offers proven, practical solutions to pest problems that us physical, mechanical, cultural, and biological control rather than chemicals.

Schultz, Warren, ed. **Natural Insect Control: The Ecological Gardener's Guide to Foiling Pests.**
1994. Brooklyn Botanic Garden, Inc.
Information on how to tell good insects from bad insects, how to naturally control pests naturally, and much more.

Attracting Specific Wildlife

Bats

Tuttle, Merlin D. **America's Neighborhood Bats.**
104p. 1988. University of Texas Press.
Behavior and biology of bats, including color photos and range maps.

Tuttle, Merlin D. and Donna L. Hensley. **The Bat House Builder's Handbook.** 34p. 1993.
Bat Conservation International. Excellent information on bats and bat houses. Contains the results of years of research on size, color and placement of bat houses. Also included is information on how to participate in ongoing bat research through membership in Bat Conservation International (application card included).

Birds

Dennis, John. **The Complete Guide to Bird Feeding.**
1994. Alfred A. Knopf.

Information on what birds to expect when and how to choose the right bird feeder and stock it with the most suitable bird feed.

Halpin, Anne. **For the Birds!**
1996. Henry Holt.

Harrison, George H. **Garden Birds of America.**
1996. Willow Creek Press.
Information on how to attract birds, including suggestions on what to plant, feeders and food, and size and placement of birdhouses. Color photos of 60 popular garden bird species, with information on their ranges, and natural history.

Kress, Stephen W. **The Bird Garden.**
1995. Dorling Kindersley.
Comprehensive guide to attracting birds to your yard or school year round using bird feeders and recommended plants.

McKinley, Michael and John Dennis. **How to Attract Birds.**
1995. Ortho Information Services.
How-to information on attracting birds by providing food, water, shelter, and nesting sites.

Butterflies and Hummingbirds

Dennis, John and Matthew Tekulsky. **How to Attract Hummingbirds and Butterflies.**
1990. Ortho Information Services.
Provides plant selection lists and necessary design elements for the most common species of hummingbirds and butterflies.

Pyle, Robert J. **Audubon Society Handbook for Butterfly Watchers.**
1984. Charles Scribners Sons.
Practical field advice, including what to wear, equipment to carry, identification chart, and more.

Stokes, Donald W. and Lillian Q. Stokes. **The Hummingbird Book.**
1989. Little, Brown and Co.
Information on how to attract and identify hummingbirds.

Xerces Society Staff. **Butterfly Gardening.**
1990. Sierra Club Books.
Information on how to create a butterfly habitat, overview of the life cycle of butterflies.

and moths, regional lists and pictures of the most common North American butterflie. and moths, and much more.

Habitat Restoration

Chesky, Edward D. **Habitat Restoration: A Guide for Proactive Schools.**
1993. Waterloo County Board of Education.

Firehook, Karen and Jacqueline Doherty. **A Citizen's Streambank Restoration Handbook.**
1995. Izaak Walton League of America (Save Our Streams).

Riley, Ann L. **Restoring Streams in Cities: A Guide for Planners, Policymakers and Citizens.**
1997. Island Press.
Presents land use planning, site design, and watershed restoration techniques that can be used to restore urban streams.

School Greening

Chase, Jayni and Thomas E. Lovejoy. **Blueprint for a Green School.**
1995. Scholastic Inc.
Very complete guidebook on environmental issues and school grounds. Includes an extensive resource list.

Field Guides

The Peterson Series Field Guides; *over 55 titles, covering North America.* Houghton Mifflin.

The Audubon Society Nature Guides; *series which focuses on ecosystems and habitat types.*
Alfred A. Knopf.

The Stokes Nature Guides; *including three volumes of Guide to Bird Behavior.* Little, Brown, and Co.

Children's Books

There are thousands of excellent children's books written about plants, animals and the environment. These are a few of the most relevant: how-to habitat guides for children, books that involve children starting successful gardening projects in their neighborhoods, and books in which children are discovering wildlife where they live.

Bash, Barbara. **Urban Roosts: Where Birds Nest in the City.**
San Francisco: Little Brown and Company, 1990.
Informative book on urban wildlife for readers ages 9-12.

Bunting, Eve. **Secret Place.**
New York: Clarion Books, 1996.
Story of young boy's discovery wildlife in the city.

Herberman, Ethan. **The City Kid's Field Guide.**
New York: Simon and Schuster. 1989.
Educational information geared towards kids on the types of wildlife found in the city and how they survive.

Fleischman, Paul. **Seedfolks.**
New York: Harper Collins, 1997.
Short novel for middle school students; 9 year-old girl starts a community garden and brings together her diverse neighborhood and their stories.

Perenyi, Constance. **Growing Wild: Inviting Wildlife Into Your Yard.**
Hillsboro, OR: Beyond Words Publishing, Inc., 1991.
Wildlife habitat creation how-to guide for kids.

Tamar, Erika. **The Garden of Happiness.**
San Diego, Harcourt Brace and Co., 1996.
Mariso, the main character, works with her neighbors to transform a garbage-filled lot in their inner city neighborhood into a community garden. Recommended for readers age 4-8.

Thornhill, Jan. **Wild in the City.**
San Francisco: Sierra Club Books for Children, 1995.
Jenny and her mother are surprised to discover all the wild creatures that are living in their urban yard. At the end of the story are details about the animals in the book, as well as hints about how to find clues to their presence in your own neighborhood. Recommended for readers age 4-8.

BEST COPY AVAILABLE

Fundraising and Grant Resources

The organizations below have been selected because of their support of environmental projects that involve youth by providing funding and materials for educators throughout the U.S. For further specifics, contact the organizations directly. For more information on region-specific grant sources, see the Schoolyard Habitats Program website: www.nwf.org/schoolyardhabitats.

National Wildlife Federation's Schoolyard Habitats Program Mini-Grants:
Each year, Schoolyard Habitats Program offers $250.00 mini-grants to schools in the early stages of their Schoolyard Habitats projects. Applications become available in October and are due on January 15th. Visit our website (www.nwf.org/schoolyardhabitats) for details and to download the application.

America the Beautiful Fund
1511 K Street, NW Suite 611, Washington, D.C. 20005 (202)6381649
www.america-the-beautiful.org/html/abf/news/freeseedsorder.htm/
Simple application process. Seeds are free; applicant only pays shipping and handling costs of $12.00/100 packs of seeds.

Human-I-Tees Fundraisers
400 Columbus Avenue, Valhalla, NY 10595 180098-EARTH
www.humanitees.com
Provides free shipping and low-cost environmental products for school fundraisers.

National Tree Trust
Community Tree Planting Program, 1120 G St. NW, Suite 770,
Washington, DC 20005 1-800-846-8733 www.nationaltreetrust.org
Public schools can apply to receive free tree seedlings through NTT's Community Tree Planting program. Containers and monetary soil subsidies are also available.

The Captain Planet Foundation
One CNN Center, Atlanta, GA, 30303 (404) 827-4130 www.turner.com/cpf
Awards grants to support hands-on environmental projects with youth. Application is available online or by mail; submit anytime; applications are reviewed in March, June, September and December.

The Center for Environmental Education
"Make Your World Better" Grant Program, Antioch New England Graduate School, 40 Avon St., Keene, NH 03431 (603) 357-3122
www.cec-ane.org/
Grants range from $1000-$5000 to initiate environmental education projects. They encourage multi-disciplinary projects that involve teachers working collaboratively; they also favor projects that focus on the local school, community and ecosystem. Proposal dues Nov. 1st with notification in January; spring deadline is March 15, with notification on May 15.

Environmental Protection Agency (EPA)
Headquarters Office of Environmental Education, 1200 Pennsylvania Ave. NW, 1704, Washington D.C. 20460 (202) 260-4965
www.epa.gov/enviroed/grants.html/
Applications are due in November, and announced the following summer. Grants of up to $25,000 are available.

The Jordan's Fundamentals Grants Program
National Foundation for the Improvement of Education, 1201 16th St., NW, Washington, D.C. 20036 www.nfie.org/jf.htm
Grants recognize outstanding teaching and extend student learning in public secondary schools that serve economically disadvantaged students. Grants are awarded based on original lesson plan or thematic units. Four hundred $2500 grants are awarded each year. Application available online.

National Environmental Education and Training Foundation
1707 H St., NW, Suite 900, Washington D.C. 20009 (202)833-2933
www.neetf.org
NEETF issues challenge grants of $5000-$40,000 in three categories: Health and Environment; Safe Water; and Environmental Education Excellence.

National Gardening Association – *Youth Garden Grants*
1100 Dorset St., South Burlington, VT 05403 1 800 538-7476 x205
http://www.kidsgardening.com/grants.asp/
Four hundred grants of quality tools, seeds and garden products, (valued at $750) are available each year. To be eligible groups must plan to garden with at least 15 children between the ages of 3-18.

Sea World/Busch Gardens Environmental Education Awards
Education Department, 7007 Sea World Drive, Orlando, FL 32832
1-877-792-4332 www.seaworld.org/EEAwards/eea01.htm
Because this is an awards program, applicants must be able to demonstrate significant accomplishments by the time of their application. Eight $10,000 grants are awarded

to schools, and one $5000 grant is awarded to a teacher each year. K-12 schools in the U.S. and Canada are eligible to apply.

Toyota TAPESTRY Grants for Teachers
c/o National Science Teachers Association, 1840 Wilson Boulevard,
Arlington, VA 22201 www.nsta.org/programs/toyota.htm
This grant is available to elementary teachers who do some science is their classrooms, and to middle and high school teachers who spend at least 50% of their time teaching science. Grants are given to innovative projects that enhance science education in the school and/or school district.

Fundraising Reference Guides

Environmental Grantmaking Foundations Directory
P.O. Box 22770, Rochester, NY,
146922770, 1 800 724-1874

The Foundation Center
79 5th Ave., New York, NY 10003 (212) 620-4230 www.fdncenter.org/
Their website includes a weekly "Philanthropy News Digest," and online fundraising library, a searchable database of funding opportunities, and online training about grant seeking and proposal writing.

Habitat Creation

Wild Ones Landscapers
http://www.forwild.org/
Site is dedicated to the importance of landscaping with native plants. Includes an excellent "how-to" handbook that guides you through the creation of native plant landscapes and habitat for wildlife.

Online Resources

Sources of Materials

Let's Get Growing
http://www.letsgetgrowing.com/
Online catalog full of tools, teaching aides, books, and much more to use with your Schoolyard Habitats site.

Gardens for Growing People
http://www.svn.net/growpepl/
Catalog for ordering child-sized tools, books, curriculum, and much more. The site also offers tips for gardening with children and a free newsletter.

Learning Through Landscapes
http://www.ltl.org.uk/
A UK based program that promotes thoughtful design and use of school grounds. A source for a high quality schoolyard curriculum series (i.e. English in the School Grounds, Math in the School Grounds) as well as guidebooks addressing specific issues, such as seating, maintenance, and fundraising.

Curriculum and Activities

The National Gardening Association's Kids Gardening Page
http://www.kidsgardening.com/
Great information for teachers and parents on gardening projects to do with children. Site contains a wealth of information, including recommended books for children and adults, grant opportunities, key word curriculum search, and a free online newsletter.

The Wild Ones
http://www.thewildones.org/
International program that offers curriculum ideas, resource lists, free newsletters, information on research projects that classrooms can join, and much more. Site is also available in Spanish and Portuguese.

Classroom Projects

Journey North
http://www.learner.org/jnorth/
Free online program through which classrooms can track the spring migration of various animal species. Students share their information with other classrooms across the hemisphere and work directly with scientists. The site also provides lesson ideas and a forum for online teacher discussions.

Classroom Feeder Watch
http://birdsource.cornell.edu/cfw/
Great program run by Cornell University that allows classrooms to participate in o ngoing ornithology research projects. Includes curriculum ideas and National Science Education Standards links.

Monarch Watch
http://www.monarchwatch.org/
Site has a great deal of information related to teaching about monarchs in the classroom. Included on the site are details on the monarch life cycle, instructions on how to rear monarchs and grow milkweed, and opportunities for students to participate in research projects with scientists.

BEST COPY AVAILABLE

American Horticultural Society
http://www.ahs.org/
Plant related information and links to a national list of children's gardens (under the Gardening Connections section).

The Lady Bird Johnson Wildflower Center
http://www.wildflower.org/
Regional native plant lists, as well as educator kits, which contain plant information and posters for use in the classroom, can be purchased on the site.

Species 2000
http://www.sp2000.org/
Great starting point for learning about specific plant and animal species. Includes in-depth information and a variety of helpful web links.

Plants and Wildlife

Butterflies of North America
http://www.npwrc.usgs.gov/resource/distr/lepid/bflyusa/bfly.htm
Excellent source of region-specific information about butterflies, complete with county checklists, distribution maps and photos.

Bat Conservation International
http://www.batcon.org/
Provides information on bats, building bat houses, and ordering bat-related educators' guides.

Environmental Literacy Council
http://www.enviroliteracy.org/
Comprehensive information and valuable links on key environmental issues. Also includes reviews of advanced placement environmental science text books.

The Center for Environmental Education
http://www.ceeane.org/
Contains a searchable database of environmental education programs. Helpful source of topic-specific curriculum and articles and provides curriculum evaluations.

EE-Link
http://eelink.net/

Offers links to many websites, including sites on curriculum ideas, grant opportunities, and environmental education publications.

Environmental Education Clearinghouses

ERIC Clearing House for Environmental Education
http://www.ericse.org/eeindex.html
Information on environment-focused books, conferences, lesson plans, journals, and web sites.

Listserv

School Garden Listserv
A forum for discussing school garden issues. This list is open to all interested in or who are participating in school garden creation, use, maintenance and study. Participants discuss issues pertaining to pre-school, elementary, and secondary schools. To subscribe, visit http://www.mallorn.com/mailman/ listinfo/school_garden.

Garden Supply Resources

Acorn Naturalist
17821 East 17th St., #103
PO Box 2423
Tustin, CA 92781-2423
Resources and curricula for the trail and classroom

Applewood Seed Company
5380 Vivian Street
Arvada, CO 80002
Phone: (303) 431-6283 Fax: (303) 431-7981
Children's gardening products.

Arbour Recycled Products
800 Bank Street
Ottawa, Ontario K1S3V8
Phone: (613) 567-3168 Fax: (317) 567-3568
Vermicomposting (composting with worms) 25-minute video.

Banana Slug String Band
390 Big Creek Road
Davenport, CA 95017
Phone: (408) 429-9806
Cassette tapes and video with sing-along songs about gardening and the environment.

Botanic Garden Seed Company
225 Fifth Avenue #617
New York, NY 10010
Phone: (212) 679-6015
Seeds and line of supplies for children.

The Bug Store
http://www.bugstore.com
113 W. Argonne
St. Louis, MO 63122
An online catalog selling everything from ladybugs, lacewing to praying mantis.

Burpee Seed Co's Grow America
www.burpee.com
W. Atlee Burpee Company

300 Park Avenue
Warminster, Pa 18974
Phone: 215-674-4900 or 800-888-1447 Fax: 215-674-8402
Seeds and gardening supplies, seed planting campaign for children, free press kit.

Clyde Robin Seed Company
www.dirtgardener.com/clyderobin/
3670 Enterprise Avenue
Hawyard, CA 94545
Phone: (510) 785-0425
Wildflower seeds.

The Cook's Garden
www.cooksgarden.com
P. O. Box 535
Londonberry, VT 05148
Phone: 802-824-3400 Fax: 802-824-3027
Seeds, plants and organic gardening supplies. Emphasis on family gardening.

Garbage Bag Gardens
1711 Stockton Hill Road, No. 310
Kingman, AZ 86401
Phone: (602) 757-4762
Plastic garbage bag containers for growing plants in classrooms and outdoor areas. Posters.

Gardeners' Supply Company
www.gardeners.com/gardeners
128 Intervale Road
Burlington, VT 05401-2850
Phone: 802-863-1700
Child-sized gardening tools.

Gardens for Growing People
P. O. Box 630
Point Reyes, CA 94956
Phone: (415) 663-9433 E-mail: GrowPepl@svn.net
http://www.svn.net/growpepl/
Garden supply catalog/newsletter.

Granite Seed

1697 West 2100 North
P. O. Box 177
Lehi, UT 84042
Phone (801) 768-4422 or (801) 531-1456
Grass seeds, shrubs, reclamation plants.

Heritage Gifts, Inc.
1203 Spring Street
Latrobe, PA 15650
Phone: (412) 537-0878 or (800) 597-2275 Fax: (412) 539-2298
Garden gifts, including Bark Buddy plush tree with seed kit.

Jackson and Perkins
http://www.jacksonandperkins.com
1 Rose Lane Dept. 7274
Medford, OR 97501
Offers a nice selection of miniature roses for growing indoors plus basic rose and perennial care basics.

Jonny's Selected Seeds
www.jonnyseeds.com
Foss Hill Road
Albion, ME 04910
Phone: 207-437-9294 Fax: 207-437-2165
Vegetable, flower and herb seeds, books and supplies.
Educational group discounts.

Lets Get Growing
www.letsgetgrowing.com
1900 B Commercial Way
Santa Cruz, CA 95065
Phone: 408-464-1868 Fax: 408-476-1427
Complete selection of children's gardening curriculums; tools and indoor gardening projects.

Northrup-King Lawn and Garden
7500 Olson Memorial Highway
Golder Valley, MN 55427
Phone: (612) 593-7265
Child-sized garden tools, garden supplies.

Shepherd's Seeds
www.sheperdseeds.com
30 Irene Street

201

Torrington, CT 06790
Phone: 203-482-3638
Online catalog with over 500 seed varieties including a line of children's garden seeds. Reference library with a number of basic growing guides.

Stokes Seeds
http://Vaxxine.com/seeds
Box 548
Buffalo, NY 14240-0548
Phone: 716-645-9649
Stokes Seed Company has been around for over 115 years. Stokes has one of the best selections of vegetable seeds available at a good price. This site also includes a plant hardiness zone map and gardening links.

Territorial Seed Company
www.territorial-seed.com/
P. O. Box 157
Cottage Grove, Oregon 97424-0061
Phone: 541-942-9547
Good online selection of vegetable, flower and herb seeds

Van Bourgaondien & Sons, Inc.
www.dutchbulbs.com
P. O. Box 1000
Babylon, NY 11702
Great selection of high quality bulbs and perennials.

Virginia Berry Farm
P. O. Box 4
Ruther Glen, VA 22546
Phone: (804) 448-4430
Blueberry poster.

Wee Share International
P. O. Box 1028
Pagosa Springs, CO 81147
Phone: (800) 874-2733
Wee Sprouts Salad Kit.

Wild Birds Unlimited
Headquarters:
11711 N. College Ave., Suite 146
Carmel, IN 46032-5655
Phone: (888) 302-2473 FAX: (317) 571-7110

202

Schoolyard Habitats® Accessibility Guidelines

When creating a Schoolyard Habitats site it is important to consider the needs of people as well as wildlife, including people with disabilities. When possible, add accessible elements to the habitat design that will enhance the usability of the space for all people (i.e. people with disabilities, senior citizens, parents with strollers, etc.).

Of course, the size and location of the habitat area and budget will determine what accessible elements are reasonable to include in the site. The following items are low-cost and easily implemented suggestions. If there is no way to include these in the original design, consider adding more accessible elements into the long-range plan for the wildlife habitat site.

Note: If the habitat site is developed at a public or government facility or the project funding comes from federal, state or local government sources, the site must be accessible according to the Americans With Disabilities Act requirements. Please contact the United States Access Board at www.access-board.gov for additional accessibility guidelines.

Location

- Choose a site that is largely accessible (i.e., level, easy to get to, does not flood, etc.).
- Place the habitat close to a building.
- Take advantage of existing paths or sidewalks for aecess.
- Choose a site that is close to a water source for ease of maintenance.

Pathways

- Width: Optimal recommended width is 60 inches with a minimum recommended width of 48 inches.
- Surface: Should be firm and stable. Recommended surface options include pavement, textured concrete and screenings. Screenings are made from a mixture of small pieces of rock (no greater than 1/4 inch in size; typically limestone or greenstone) and dust to stabilize it. Brick and boardwalk style pathways become slick when wet and can be a safety risk. Rock, wood chip and stepping stone paths are not recommended.

◇ Slope: Recommended 5 percent or less running slope (grade). Recommended cross slope is 2 to 3 percent.

◇ Ramps: Any time the grade of a path exceeds 5 percent, provide a ramp. If a ramp is needed, the least amount of slope possible is recommended. A maximum acceptable slope is 1:12 (e.g., a one-inch rise for every twelve inches of distance). Ramps are required to have a level, 60-inch minimum landing immediately before and after a sloped run, and a landing must be installed for every 30 feet of sloped run.

◇ Handrails: Handrails are recommended for safety purposes any time an element such as a ramp or bridge is present on a path. The gripping surface of handrails should be between 1 1/4 and 1 1/2 inches wide. Recommended handrail heights for adults should be 34 to 38 inches; heights for children should be 20 to 27 inches.

◇ Obstacles: Paths should be free of any obstacles such as roots, rocks, and/or steps. There should be ample head and side clearance (i.e. from tree branches) for individuals at standing and seated levels. It is important to maintain pathways for safety.

Planting Beds and Containers

◇ Create raised planting beds or boxes to accommodate individuals who use wheelchairs, senior citizens and other individuals with limited mobility. There are a variety of styles and heights that can be used; if possible use a mixture of heights to accommodate the greatest range of individuals.

◇ Create a sensory garden (in which visitors can smell, touch and hear) in a raised bed or standing planter box for individuals with visual impairments. This allows individuals to comfortably explore and experience the plantings.

◇ Raise plants vertically with trellises to provide access to plants for a greater number of individuals.

◇ Containers are an inexpensive way to created raised plantings. Whiskey barrels and other large planters are excellent heights for wheelchair access. In addition, you can use plant stands, existing walls, etc. to place containers at different heights.

◇ If possible, use a multi-layered landscape design to increase access to all individuals.

Tools

- A variety of adaptive gardening tools are available, including long-handled tools, tools with adaptive handles, lightweight and comfort-grip tools. The handles of traditional gardening tools can be modified with tape/foam/or bandage material for gardeners with limited muscle strength, coordination or dexterity of the hands.

- Have gardeners who have difficulty carrying items wear an apron with pockets or secure a lightweight bag or basket on their wheelchair or walker.

- If possible, provide a tool storage shed in or near the habitat.

- To increase comfort, have gardeners who have difficulty bending or have joint pain use kneelers, knee pads, or a small stool.

- Use tools with brightly colored handles or paint or tape the handles white to provide contrast for gardeners with low vision.

Signage

- Interpretive signs should not be text-heavy; text should be in large, no-glare block letters. When possible, utilize pictures and/or symbols.

- Make Braille plant labels for raised bed sensory gardens.

- For larger public gardens, incorporate an auditory interpretation system into signage.

Miscellaneous

- Add benches for people to rest. Benches should have back supports and an armrest on at least one end for safety purposes. If possible, place benches in shade. Recommended spacing between benches is 100 feet or less, depending on the size of the habitat.

- Choose plants for scent and tactile recognition for gardeners and visitors with visual impairments.

- Use sound-producing elements such as wind chimes, a waterfall or a fountain to help provide orientation in the habitat for gardeners and visitors with visual impairments.

Using a Compass

Using a compass is quite simple, but it may take some getting used to. Here are a few simple directions that will work for most compasses:

1. Keep the compass flat at all times.

2. Rotate the compass so that the red pointer needle is inside the white arrow. It should point in the same direction as the white arrow. If you then face your body in the same direction the arrows are pointing, you will be facing north.

3. If you are facing north, west will be on your left, east on your right, and south directly behind you.

4. The whole circle is 360 degrees. North is at 0 degrees, east is at 90 degrees, south is 180 degrees, and west is 270 degrees.

If your students are unfamiliar with using a compass, you may want to do several preliminary activities to get them comfortable with this useful equipment.

The instructions that come with compasses often include interesting activities, and **The Basic Essentials of Map and Compass** by Cliff Jacobson (1999) is also helpful.

Container Gardening

Some schools have little or no land available for planting, generally because most of the grounds have been paved with asphalt. Sometimes schools have engaged in highly successful projects which begin with engaging community resources in tearing up part or all of their school's asphalt. If you are unable to do so at this time, you can still have success with a small site or on grounds with poor soil by creating your wildlife garden in containers. Many schools have grown thriving gardens on top of asphalt, rooftops, and paved courtyards in this way.

Container Selection

In selecting containers, you may choose the traditional clay or plastic pots available at any nursery. When buying plastic containers, avoid dark colors that will absorb sunlight, and overheat your plants' roots. Any container you plant in must have drainage holes which are large enough so that excess water can drain, but small enough so that soil is not lost through the openings.

Another option is to build your own wooden planter boxes.. When selecting lumber, choose wood that naturally resists the damaging effects of water; avoid wood treated with preservatives containing pentachlorophenal. Containers holding large trees should be built so they are easy to take apart (i.e. with nuts and bolts) for periodic root maintenance.

To make containers accessible for those in wheelchairs, mount your containers on sawhorses or wooden legs. Raised beds should have 27" clearance from the ground to the bottom of the bed to be wheelchair accessible. For more information on accessible gardens, visit http://www.ahta.org .

Soil and Water Basics

Drainage is very important in container gardening. Make sure your containers allow excess water to flow through, since water trapped at the bottom of the plant can harm, and eventually kill, some plants. To ensure proper drainage, buy pots with drainage holes or drill holes into your containers and planter boxes.

A mix of organic matter, vermiculite and peat moss will provide good drainage in containers. Traditional potting soil often does not hold moisture well; contact your local nursery or cooperative extension in choosing the proper mix for your plants. Leave at least two inches of space between the top of the container and the top of the soil.

The National Gardening Association's online catalog offers several containers and kits for easy-to-construct planter boxes. Visit http://www.kidsgardening.com.

Rooftop Gardening

If your school has limited land to use for creating a wildlife habitat and outdoor classroom, consider creating a garden on the school rooftop. Be sure to check with the maintenance facilities personnel in early discussions. Your plants will be exposed to more wind and sunlight on the roof than they would be at ground level. To compensate for this, choose hardier plant varieties. Simple structures such as wooden trellises or burlap screens can provide some wind protection and areas of shade.

To learn about the City of Chicago's efforts to reduce energy demand and improve air quality, visit: http://www.ci.chi.il.us/Environment/html/RooftopGarden.html

Also visit the **Rooftop Gardens Resource Group**
http://www.interlog.com/~rooftop and
City Farmer's Rooftop Gardening Information Page:
http://www.cityfarmer.org/rooftop59.html

Habitats Feedback Form

National Wildlife Federation

To produce a more accurate, effective, and user-friendly product, we need your feedback. Please let us know what you think of this curriculum. Once you have completed this form, please return all comments to the address below. ***Please feel free to use separate pages to answer questions or add additional comments.*** Be as specific as possible. Thanks so much for your time and assistance!

Optional

Your Name:

Address:

Phone: Email:

General:

1. Overall, how effective is this curriculum in preparing educators to create a Schoolyard Habitats site ? Is there anything missing? How might we remedy this issue?

2. How useful and complete were the Introduction, Kit Tips and Background sections? Did you identify any particular topics that could be added or expanded upon?

3. Please comment on specific activities in the Activities section, especially those you found especially helpful or those that need improvement. Please indicate anything that you found unclear.

4. Did you modify any of the activities for your students? If so, how?

5. How well do the activities reflect the grade level range they have indicated?

6. Please comment on the Schoolyard Habitat Planning Guide. Does it have enough inormation and guidance to help you create a Schoolyared Habitats site?

7. Have you created a Schoolyard Habitats site? If so, do you plan to certify your Schoolyard Habitats site? If not, why? How have you used your Schoolyard Habitats site in cross-curricular learning? We are eager to hear examples!

Additional comments:

Return to:
Schoolyard Habitats
National Wildlife Federation
11100 Wildlife Center Drive
Reston, VA 20190-5362

NATIONAL
WILDLIFE
FEDERATION®
www.nwf.org™

National Wildlife Federation
11100 Wildlife Center Drive
Reston, VA 20190-5362

(703)790-4100
www.nwf.org

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Blanket)

I. DOCUMENT IDENTIFICATION (Class of Documents):

All Publications: Access Nature. Habitats NatureScope Kit Schoolyard Habitats: A How-To Guide for K-12 Communities	
Series (Identify Series):	
Division/Department Publications (Specify):	Publication Date:

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to each document.

If permission is granted to reproduce and disseminate the identified documents, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

Level 1

☐

Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.

The sample sticker shown below will be affixed to all Level 2A documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2A

Level 2A

☐

Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only

The sample sticker shown below will be affixed to all Level 2B documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Level 2B

☐

Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate these documents as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, → please

Signature: Stephanie Stowell	Printed Name/Position/Title: Stephanie Stowell Sr. Manager, Educator Programs
Organization/Address: NWF 11100 Wildlife Center Drive Reston VA 20190-5362	Telephone: 703.438.6468 FAX: 703.438.6468
	E-Mail Address: Stowell@nwf.org Date: 11/6/02

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of these documents from another source, please provide the following information regarding the availability of these documents. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor: National Wildlife Federation
Address: 11100B Wildlife Center Drive Reston, VA 20190-5362 phone: 1-800-822-9919
Price: $39.95 for each of the 3 titles listed

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

ERIC Clearinghouse for Community Colleges
UCLA
3051 Moore Hall, Box 951521
Los Angeles, CA 90095-1521
800/832-8256
310/206-8095 fax

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the documents being contributed) to:

ERIC Processing and Reference Facility
4483-A Forbes Boulevard
Lanham, Maryland 20706

Telephone: 301-552-4200
Toll Free: 800-799-3742
FAX: 301-552-4700
e-mail: info@ericfac.piccard.csc.com
WWW: http://ericfacility.org

EFF-087 (Rev. 9/97)
PREVIOUS VERSIONS OF THIS FORM ARE OBSOLETE.